OPERATING INSTRUCTIONS

SUN ELECTRIC CORPORATION

PROGRAM INSTRUCTIONS FOR TEST-LINK SOFTWARE

Program Description

Test Link disks contain software programs for troubleshooting vehicle on-board computer systems. There are two types of programs: monitor and diagnostic.

Monitor software allows the user to read fault codes, view system operating information or perform system component tests. Exact capabilities vary, depending on the vehicle under test. A monitor program covers one or more model years and a range of system applications.

Diagnostic software covers a particular model year and a specific type of system. In addition to the same information (depending on the vehicle) presented by the monitor program, the diagnostic software presents step-by-step problem-solving routines leading to the faulty component, followed by a repair recommendation.

Test Link software on disk is available for a variety of domestic and import on-board computer systems. Consult your Sun Sales Representative for details.

Analyzer Preparation

Test Link software can only be used with analyzers equipped with Sun's Test Link on-board computer interface. Consult the operator's manual for program disk initial operating procedures and general guidelines.

Be sure the analyzer has been warmed up and properly calibrated before on-board computer testing begins. Also make sure all test leads are properly connected.

In addition to the engine analyzer, some test procedures may require the use of jumper wires, a test light and a spark tester.

Read/Write Protect Tab

The Read/Write Protect Tab is located at the bottom left corner of the disk's labeled side (Figure 1). To protect against accidental erasure of its contents, slide the tab so that there is an opening in the disk. The tab will then be in the "protect" position. When the tab is not in the protect position, it can be seen in the bottom corner of the disk's labeled side.

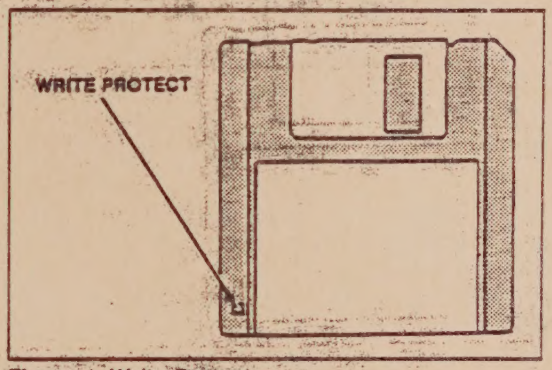


Figure 1. Write Protect

Before inserting the disk into the drive, make sure the Read/Write protect tab is in the Protect position.

Monitor Displays

Included on monitor displays or program pages are test parameters, step-by-step test instructions, and test results.

Prompts appearing on the monitor ask the technician to make test selections and keypad entries. Prompts always appear in the same location on the monitor. See Figure 2. PRESS YES OR NO, PRESS CONT, and PRESS A NUMBER are commonly used prompts.

The heading which appears at the top of pages identifies the specific section the program is in. The number directly below the heading and to the right is a program

code. This number is unrelated to the operation of the disk and may be disregarded. See Figure 2.

Diagnostic programs may reference schematic drawings printed in a Drawing Reference Guide, which is included with the Test Link disk. The figure number of the drawing for that section of the Test Link program appears in the upper right hand corner of the monitor. See Figure 2.

The HELP function is designed to provide the technician with additional information during the diagnostic program. Press HELP when the prompt appears. Figure 2 is an example of a HELP message.

The LOADING PROGRAM message appears at the bottom of the monitor when the Test Link is transferring information from the disk into analyzer memory. Wait until the next page displays before using the remote keypad.

Numeric entries on the menu pages (i.e., Main Menu, Vehicle Selection Page, etc.) each represent a different option. Always follow the prompts on each program page for specific numeric entry instruction.

If an incorrect double-digit numeric entry is made, press the CLEAR key and rekey the correct digit.

If an incorrect single-digit entry is made, the program automatically advances to the next page. Press the BACKUP key to return to the preceding page and clear and correct the incorrect digit.

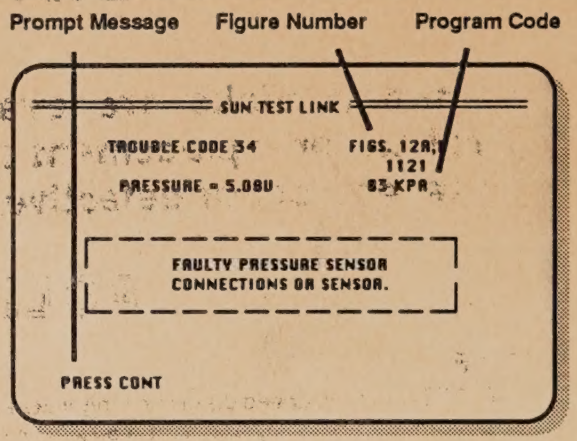


Figure 2. Example Of Help Information

Disk Structure

Test Link software features simple menu selections for test options. After selecting the correct vehicle from a vehicle selection menu, a main test menu appears, from which specific tests are available. Software differs in structure and content depending on the vehicle. In all cases, tests are self-explanatory and easy-to-follow.

Disk Maintenance

When not in use, Test Link disks should be stored in the disk drawer inside the engine analyzer console; or in a disk sleeve. On engine analyzers equipped with a hard drive, the programs on disk can be transferred to the hard drive, and accessed when needed. The Test Link disks can be kept for backups in the drawer or sleeve. If the Test Link program on the hard drive is lost for any reason, the program can be re-loaded from the backup disk.

SUN ELECTRIC CORPORATION
One Sun Parkway
Crystal Lake, Illinois 60014

0692-2063-01 REV
©1992 Sun Electric Corporation
Printed in U.S.A.

TEST LINK PROGRAM DISK REPLACEMENT PROCEDURE

Programmed disks are available from Sun Electric Corporation for replacement of your licensed disks which are damaged, lost or defective.

POLICY

DEFECTIVE OR DAMAGED: If a licensed disk is no longer useable because of physical damage or defect, you may order a replacement. You will be required to return the damaged disk within 10 days of ordering the replacement. If within the 60 day warranty, there will be no charge for the replacement disk. If beyond the 60 day warranty you will be charged a fee for the exchange; if you do not return the damaged disk, you will be charged double the exchange fee.

LOST: If a licensed disk is lost, you may order a replacement. You will be charged 50% of list price for the disk.

SHIPMENT OPTIONS

1. Ship via 1st Class U.S. Mail at no charge to you.
2. Ship via "Federal Express" (or equivalent service) with a charge to you for this service.

ORDERING INSTRUCTIONS

Call the Sun Electric Service Hotline telephone number 1-800-CALL SUN (1-800-225-5786) and tell the Customer Service Agent that you "want to order a **replacement disk**".

They will ask for your area code and telephone number, and verify your mailing address. They will also ask you if you want "next day" delivery and will tell you the current cost for that service. The disk will be sent as soon as your license and warranty status is validated. Place the defective disk in an envelope with your business name and address and mail to:

SUN ELECTRIC CORPORATION

Test Link Disk Exchange
Sun Electric Corporation
One Sun Parkway
Crystal Lake, IL 60014

If you need to follow-up your order, or want to order **additional** software, please contact your local Sun Sales Office; **do not** call 1-800-CALL SUN.

Note: OFFER VALID IN THE UNITED STATES OF AMERICA ONLY.

692-1287 (5840)
© 1985 Sun Electric Corporation
Printed in U.S.A.

SUN MODEL MEA-1500

REMOTE CONTROL

The remote control keypad is divided into three basic sections: numeric entry, VDU control, and scope control. An engine kill key is located in the upper right hand corner of the remote control.

ENGINE KILL — Press this key to electronically disable the engine (i.e. in emergency situations to stop the engine or to perform cranking tests). Press again to release. When ENGINE KILL is on, a status indicator will be displayed on the VDU.

Numeric Entry Keys

Numeric entry keys are used to make menu selections, enter numerical data, and to select a specific cylinder (i.e. for power balance or scope display). The function of the key depends on the page displayed. For example, a numeric key pressed on a power balance page will short out a cylinder. On the VEHICLE TEST page, a numeric key pressed will select a cylinder for expanded view on the scope.

NOTE: The ten (10), eleven (11) and twelve (12) functions cannot be used for numeric entries. For example, a number of cylinder entry for a 12 cylinder car is accomplished by pressing "1" then "2".

1 — 9 Press these keys to make number entries and select cylinders.

10 . Dual-function. Use the decimal point with numeric entry keys on the data entry pages; press "ten" to select the number (i.e. cylinder selection on scope control or power balance page).

11 0 Dual-function. Use the zero with numeric entry keys on the data entry pages; press "eleven" to select the number (i.e. cylinder selection on scope control or power balance page).

12 +/- Dual-function. Select plus or minus sign by pressing this key successively when required on data entry pages. Press "twelve" to select the number (i.e. cylinder selection for scope control or power balance page).

VDU Keys

VDU control keys are used to change VDU pages; to clear, print or freeze VDU data; and to select VDU pages (HELP, MENU or SET-UP).

ENTER / CURSOR Dual-function. Use cursor on data entry pages to move the cursor down the page to the next data entry line. Use enter after making a correct numeric selection whenever the word "Enter" is displayed at the bottom of the VDU in the Data Link program.

ENGINE / SET-UP Dual-function. Use set-up to advance directly to the VEHICLE SET-UP page from MEA pages. Use engine to advance directly to the VEHICLE TEST Page from Data Link pages.

Press this key to erase data prior to repeating tests or to clear a data entry field.

Press this key to stop the automatic update of data on the VEHICLE TEST page and "freeze" the data for analysis. Pressing FREEZE a second time reactivates the screen and discontinues the status indicator on the VDU.

Press the continue key when prompted. It is typically used to leave a test page, start a test, or return from HELP, VEHICLE SET-UP or DATA LINK pages.

Dual function. 1) To print out any individual data page, press the key ONCE. There will be momentary pause before the printer begins to print out the information which appears on the VDU page, except the prompt messages at the bottom.

2) To form feed the printer paper to the next top of form (perforation), press this key TWICE in rapid succession. Refer to the printer operation section for instructions on setting the top of form.

Press this key successively to change the display of VOLTS to OHMS and back again on the VEHICLE TEST page.

Press this key for help in setting up the vehicle, setting up the tester or operating the tester. Refer to the "Overview" for more details.

Press this key to return to the previous MENU page.

Press this key to answer "Yes" to a (YES/NO) question displayed on the VDU in the Data Link program.

Press this key to answer "No" to a (YES/NO) question displayed on the VDU in the Data Link program.

Press this key to review data or test results on a previous Data Link page. Refer to the backup function section for a detailed explanation of this feature.

Scope Keys

The scope control keys are used to select the type of waveform display and the scale to be read. Once selected, these settings are displayed for a short period of time at the bottom of the VDU.

NOTE: Upon power-up, the scope is automatically pre-set to display a primary circuit waveform in the display mode and high scale range.

Press this key to display a PRIMARY circuit waveform on the scope.

Press this key to display a SECONDARY circuit waveform on the scope.

SPECIAL Press this key to display an alternator output waveform (signaled from Red battery (+) lead) on the scope.

DISPLAY Press this key to display all the cylinder waveforms in a horizontal row across the scope. The number one cylinder spark line is displayed at the left of the scope with the remainder of the cylinder waveforms displayed in firing order sequence from left to right. The display will end with the firing line of the number one cylinder on the right. By pressing the appropriate key, a secondary or primary DISPLAY waveform may be viewed on the scope.

Cylinder Select

In the DISPLAY mode, the operator may press a cylinder's number on the remote control and display that cylinder in an expanded sweep above the other cylinders. The cylinder selected will be increased in size and appears in the center of the scope. Pressing the selected keypad number again returns that cylinder's waveform back into the original firing sequence.

One or more cylinders at a time can be selected. Patterns are then overlayed, similar to SUPERIMPOSED. Pressing the DISPLAY key cancels the cylinders chosen and returns the waveforms to the original firing sequence. Figures 16 and 17 show examples of secondary and primary waveforms with cylinders selected.

RASTER Press this key to display each cylinder waveform one above the other at full screen width. A RASTER display consists of the cylinder number one waveform displayed at the bottom of the scope with the other waveforms displayed one above the other in firing order sequence. By pressing the appropriate key on the remote, a secondary or primary RASTER waveform may be viewed on the scope.

SUPER Press this key to display a SUPERIMPOSED pattern, which places all the cylinder waveforms one on top of the other. By pressing the appropriate key, a secondary or primary SUPERIMPOSED pattern may be viewed on the scope.

5 MSEC Press this key to display the first five milliseconds of the waveform selected.

In DISPLAY mode, the cylinder select feature is used with the 5 MSEC sweep to show the first five milliseconds of the selected cylinder. In RASTER and SUPERIMPOSED modes, **all** cylinders will be displayed with the five millisecond sweep rate.

HIGH / LOW Press this key successively to change the range of the displayed scope pattern. The selection made will appear in reverse video on the VDU.

Primary circuit waveforms are displayed in either 0 to 500 volts using the right scale, or 0 to 25 volts using the left scale.

Secondary circuit waveforms are displayed in either 0 to 50 kilovolts using the right scale or 0 to 25 kilovolts using the left scale.

MAG OFFSET ANGLES

FORD

4-CYLINDER ENGINES

1.6	4	-068.0
1.9	4	-068.0
2.3 (OHC)	4	-052.5
2.3 (HSC)	4	-314.0
2.5	4	-068.0

6-CYLINDER ENGINES

3.3	I6	-135.0
3.8 (Early 82)	V6	-309.0
3.8 (Late 82 Up)	V6	-334.0
3.0	V6	-233.0
4.9	I6	-135.0
2.8	V6	-135.0

8-CYLINDER ENGINES

4.2	V8	-135.0
5.0	V8	-135.0
5.8	V8	-135.0

GENERAL MOTORS/AMC

ALL DISPLACEMENTS

-9.5

CHRYSLER

ALL DISPLACEMENTS

-10.0

EUROPEAN VEHICLES

Systems with on-board mag timing pick-ups are automatically detected and the correct offset angle is set to either -20.0 deg. or 0.0 deg. depending on the type of system.

SUN ELECTRIC CORPORATION
ONE SUN PARKWAY
CRYSTAL LAKE, ILLINOIS 60014
(815) 459-7700

692-1424-1 (7880)

© 1986 Sun Electric Corporation

Printed in U.S.A.

MEA-1500
Table of Contents

INTRODUCTION 1
General Information
Safety Precautions

OVERVIEW 3
Operator VDU Messages
Program Menu
Oscilloscope

CONTROLS 11
Remote Controls
Oscilloscope Control
Front-Rear Controls and Scales

TEST PREPARATION 21
Warm-up/Self-test
Calibration
Vehicle Setup

ENGINE TEST PROCEDURE 26
Introduction
Key-Off, Engine-Off Tests
Key-On, Engine-Off Tests
Cranking Tests
Running Tests
Power Balance Tests
Pinpoint Tests and Vehicle Adjustments
Ignition and Charging System Scope Testing

ON-BOARD COMPUTER TESTING 48
General
Controls
Test Preparation And Routine Maintenance Procedure

PRINTER OPERATION and MAINTENANCE 52
General Description
Printer Controls
Paper Loading
Printer Operation
Printer Maintenance

ANALYZER MAINTENANCE and SERVICE 58
General
Sample Hose Maintenance
Sample Probe Maintenance
Filter Maintenance
  Primary
  Secondary
Calibration

ACCESSORIES 63
Standard
Optional

692-1418 REV. B (9890)
© 1989 Sun Electric Corporation
Printed in U.S.A.

Figure 1. Model MEA-1500 is pictured with optional test lead boom, distributorless ignition link, test stand, and printer.

INTRODUCTION

General Information

The Modular Engine Analyzer, Model MEA-1500, shown in Figure 1, displays test data for the detection of abnormal operating conditions in gasoline internal-combustion engines. It is microprocessor-controlled and electronically self-calibrating. Testing is accomplished through:

- a 12-inch oscilloscope ("scope") that displays ignition and alternator scope patterns.
- a 12-inch video display unit (VDU) that displays digital test data and plain language instructional messages which provide assistance in operating the tester.
- a remote control that permits operation of both the VDU and scope from behind the wheel or under the hood.

The analyzer's standard and optional test capabilities and hardware are shown in Figures 2 and 3. The MEA-1500 Operator's Manual presents illustrated instructions for operating the analyzer with all options installed. Refer to "Accessories" for a complete listing with part numbers of standard and optional accessories.

MEA-1500 Test Capabilities

Standard	Optional
• RPM	• HC, CO, CO_2, O_2 emissions levels
• Dwell	• Coil (+) voltage
• Strobe timing	• Mag timing
• Battery voltage	• Amps
• Distributor volts	• Vacuum
• Pinpoint volts/ohms	• Distributorless ignition
• Scope volts, kilovolts, milliseconds	• On-board computers

Figure 2. Standard And Optional Test Capabilities.

MEA-1500 Hardware

Standard	Optional
• Analyzer console (12" scope and 12" VDU)	• Industry-standard printer
• Remote control	• Distributorless Ignition Link
• Serial I/O port	• Test lead boom
• Leads, connectors and adapters	• Test stand
	• Leads, connectors and adapters
	• Four-gas module
	• Data Link
	• Mag timing kit
	• Amps/Vac kit
	• Coil (+) kit

Figure 3. Standard And Optional Analyzer Hardware

Safety Precautions

The following precautions must always be observed when doing automotive testing.

1. Exhaust gases contain carbon monoxide which is a colorlerss and odorless lethal gas. Always work in properly ventilated areas.
2. Gasoline fumes are explosive. Do not smoke around gasoline.
3. Wipe up gasoline spills immediately and dispose of soaked rags in proper air-tight containers. Always stop leaks and clean spills immediately.
4. Check the engine oil level and add oil if necessary before testing. A vehicle should not be tested if it is low on oil.
5. Check the coolant level before testing. A vehicle should not be tested if it is low on coolant. If the engine is hot, check the level of the overflow tank.

   CAUTION: Do not open closed coolant systems while the fluid is hot.
6. Do not wear loose clothing or a necktie near an operating engine. Keep hands and hair away from moving engine parts such as fan blades, belts, or pulleys.
7. Be particularly careful not to operate the timing light too near fans or belts. The timing light may have the effect of making the fan seem to "stand still". This is a dangerous optical illusion which might cause the operator to contact the fan.
8. Safety goggles should be used when working on a vehicle to protect eyes from acid, dust, gasoline, or objects which may fly off moving parts.
9. Never look directly into the carburetor throat when cranking or running the engine. Backfiring may cause burns.
10. Never wear wrist watches, rings, or other jewelry when working on a vehicle. Such items may catch on moving parts or cause electrical short circuits, burning the wearer.
11. Avoid contact with hot surfaces such as exhaust manifolds and pipes, mufflers, catalytic converters, or radiators and hoses.
12. Do not lay tools or equipment on the battery. Accidental grounding of the battery terminals may cause shocks or burns, damage wiring, or damage the battery itself. Battery acid can damage clothing and burn skin or eyes. If you contact battery acid, wash with as much water as possible and use weak soda (such as baking soda) to neutralize the acid. If acid enters your eyes, see a doctor as soon as possible.
13. A fire extinguisher should always be kept in the work area. The extinguisher should be suitable for a range of uses including gasoline, chemical, and electrical fires.
14. High voltage is present in the secondary side of the ignition system. Always use insulated pliers when handling ignition system components while the engine is running.
15. Hydrogen gas is produced by automotive batteries. Flame or sparks near the battery may cause it to explode.
16. Place wheel chocks in front of and at the rear of the drive wheels before testing a vehicle.

OVERVIEW

Operator VDU Messages

With the exception of the oscilloscope, the MEA-1500 operates entirely through individual display screens, called "pages", which appear on the Video Display Unit, commonly referred to as a VDU. A "menu" page contains a list of options from which the operator is prompted to make selections.

To make menu selections, and to advance from page to page, the operator follows the prompt messages which appear on the VDU. Prompt messages usually ask the operator to make remote control entries. If a specific key should be pressed to complete a required action, the key's abbreviation will be highlighted in reverse video on the VDU. This means the key letters will be contrasted in black against a bright green VDU background.

Status indicators are another type of operator message, which indicate the state of tester settings, controls, and hookups. Some status indicators will flash on the VDU when the operator's immediate attention is required. For example, the TRIGGER PICKUP NOT SENSED message flashes on the POWER BALANCE page if the trigger pickup is not connected properly.

"Help" messages are supplementary pages which tell the operator how to perform a specific task. They contain information on 1) analyzer set-up, 2) vehicle set-up, 3) analyzer operation and 4) vehicle connections. The help messages (which explain the tasks related to an individual page) are available by pressing the HELP key when the page is displayed.

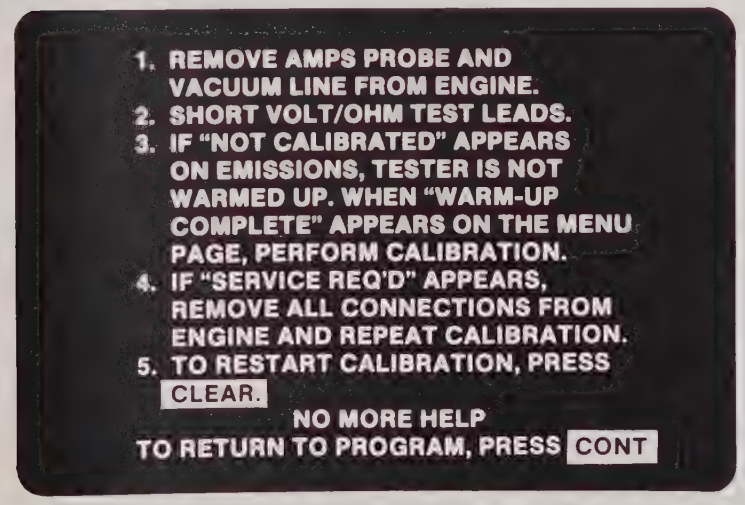

1. REMOVE AMPS PROBE AND VACUUM LINE FROM ENGINE.
2. SHORT VOLT/OHM TEST LEADS.
3. IF "NOT CALIBRATED" APPEARS ON EMISSIONS, TESTER IS NOT WARMED UP. WHEN "WARM-UP COMPLETE" APPEARS ON THE MENU PAGE, PERFORM CALIBRATION.
4. IF "SERVICE REQ'D" APPEARS, REMOVE ALL CONNECTIONS FROM ENGINE AND REPEAT CALIBRATION.
5. TO RESTART CALIBRATION, PRESS CLEAR.
NO MORE HELP
TO RETURN TO PROGRAM, PRESS CONT

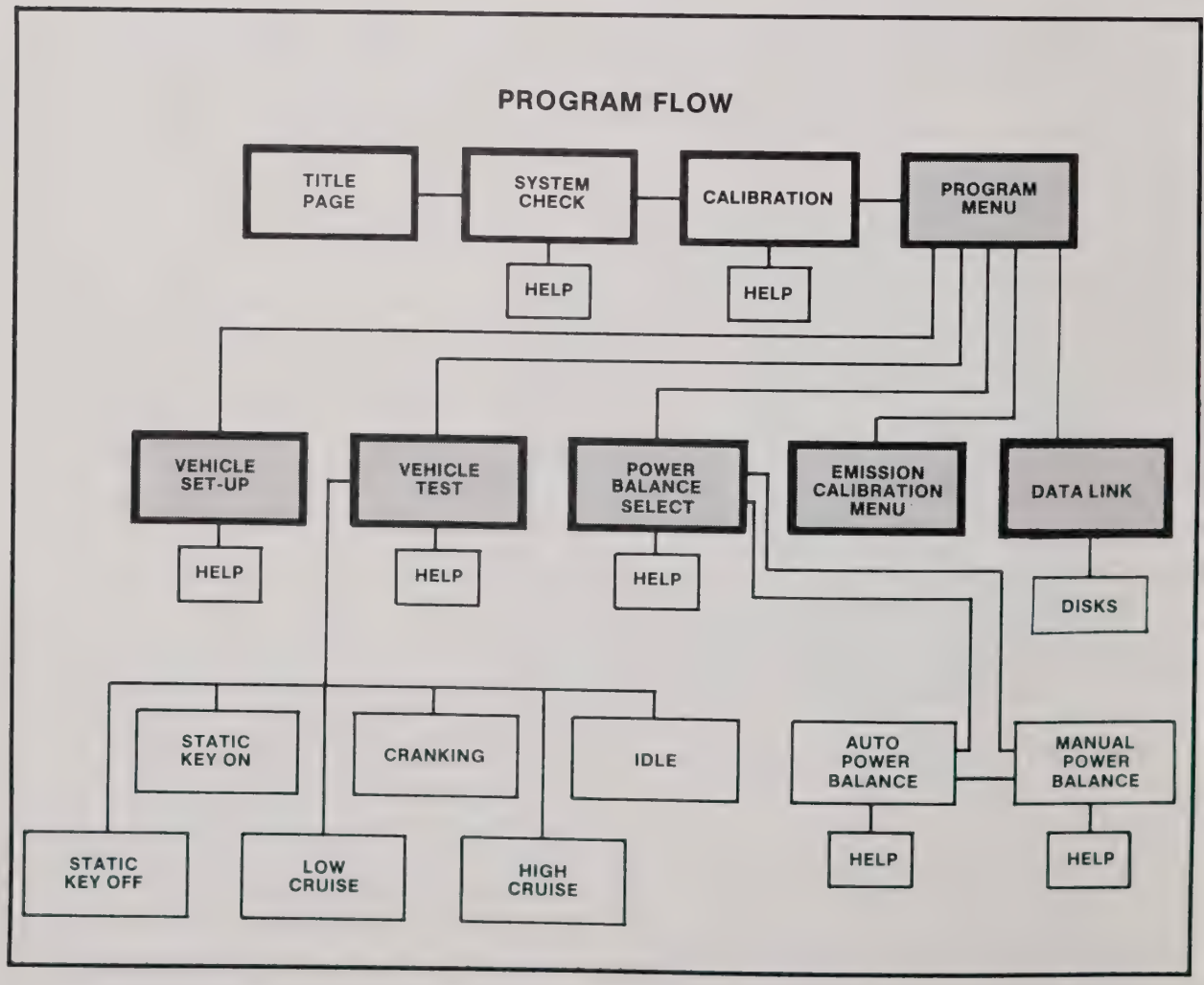
Figure 4 shows a help message which can be reached from the CALIBRATION page and explains what the operator needs to know to successfully complete calibration. Note the prompt message at the bottom of the page with key in reverse video.

The analyzer's primary menu is the PROGRAM MENU page (Figure 5), which contains four options. Brief descriptions of each option's purpose and principal features appear in the following paragraphs. The PROGRAM MENU page can be reached at any time by pressing the MENU key once or twice, depending on where you are in the program. To select an option on the PROGRAM MENU, press the key number corresponding to the menu selection on the remote control.

PROGRAM MENU

1. VEHICLE SET-UP
2. VEHICLE TEST
3. POWER BALANCE
4. CALIBRATION
5. DATA LINK

Figure 5 shows the Program Menu from which the operator selects the desired analyzer function.



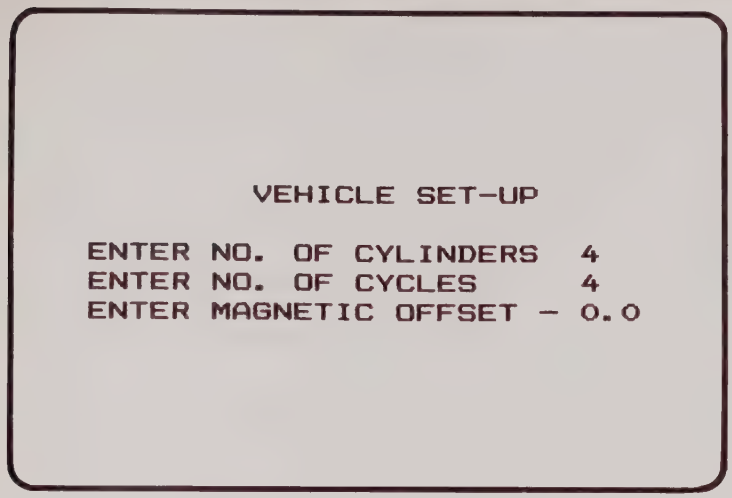


Figure 6. The engine analyzer is preset for the most common four-cylinder vehicles. Help messages detail how to change the settings if needed.

Selection #1: Vehicle Set-up

The VEHICLE SET-UP page (Figure 6) is used to set three vehicle specifications: no. of cylinders, no. of cycles and magnetic offset angle.

Upon analyzer power-up, the vehicle set-up is preset for 4-cylinders, 4-cycles, and a magnetic offset angle of 0.0.

The analyzer accepts 3, 4, 5, 6, 8 and 12 cylinders, two or four cycles, and magnetic offset angles of between 0 and -359.9 degrees. A list of mag offset angles for Ford, GM, Chrysler and European vehicles appears in the MEA-1500 Quick Reference Guide. The mag offset angle and the no. of cylinders selected appear at the bottom of the VEHICLE TEST page. Refer to Figure 7.

If the vehicle being tested is equipped with built-in magnetic timing sensors, the magnetic offset angle will automatically be adjusted, and will override any preset angles. This usually applies to European vehicles only and the angle will be preset to -20 or 0.

The operator can quickly advance to the VEHICLE SET-UP page from any other page by pressing the SETUP key, and return to the original page by pressing the CONT key. Refer to "Test Preparation" and "Controls" for data entry instructions.

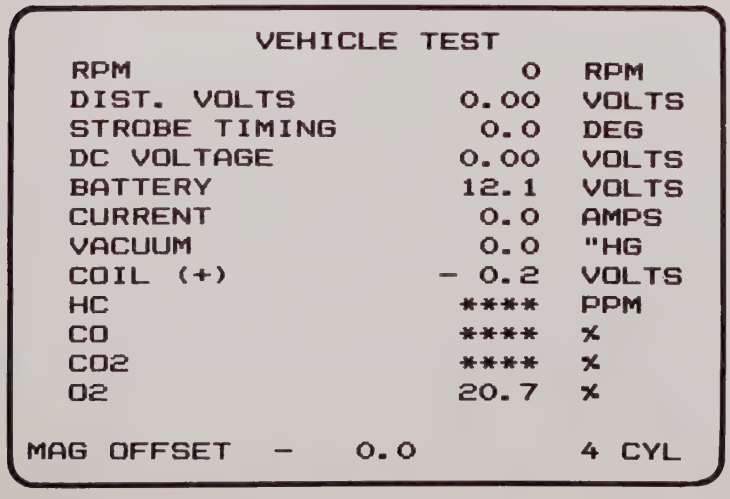


Figure 7. Help messages that detail how to hookup the vehicle for testing can be reached from this page. Note the first and second lines (RPM and Dist. Volts). Dist. volts changes to Dwell when there is RPM. The asterisks by the gas readouts indicate that the emissions module is not calibrated, or not warmed up. The strobe timing line changes to mag timing when mag timing pulses are sensed. If an option is not installed, NOT ACTIVE will appear next to its test measurement.

Selection #2: Vehicle Test

The VEHICLE TEST page (Figure 7) is used to perform key-on and key-off tests, cranking tests, running tests, pinpoint tests and vehicle adjustments. Refer to "Test Procedures" for instructions.

Standard test measurements include engine speed, dwell/distributor volts, strobe timing, DC voltage/ohms, and battery. Dwell is measured in both degrees and percent. When RPM is 0, the dwell reading on the VDU changes to DIST. VOLTS (distributor volts) for checking distributor resistance under static conditions. For pinpoint tests, the DC Voltage reading may be switched to ohms (and back to volts) by pressing the VOLT/OHM key successively.

Optional test measurements include amps, magnetic timing, vacuum coil (+), HC, CO, CO_2, 0_2 or HC and CO. If the mag timing probe is used, the strobe timing line automatically switches to mag timing on the page. Vacuum is normally displayed in inches of mercury (HG), but may be displayed in millibars (MBAR) when a service adjustment is performed. If an option is not installed, NOT ACTIVE will appear next to the test measurement.

```
        POWER BALANCE TEST
RPM    1065          BASE RPM   1194
CYL   RPM CHANGE
 1      - 126
 2      -  97
 3      - 104
 4      -  93
 5      - 123
 6      -  76
HC(X)                      5143 PPM
02                          6.3 %
VACUUM                     14.2 "HG
```

Figure 8. This page has help messages that detail how to prepare the vehicle for power balance tests and how to perform them. The HC, O_2 and Vacuum appear only when manual power balance tests are performed. The HC channel is displayed with an (X), for extended range, to indicate that readings are displayed above the normally standard maximum range of 2000 ppm.

Selection #3: Power Balance

The POWER BALANCE TEST page (Figure 8) is used to perform either an automatic power balance or a manual power balance. In the automatic power balance, each cylinder is shorted out automatically in firing order sequence and an individual RPM CHANGE reading is displayed.

In the manual power balance, cylinders may be selectively shorted while displaying corresponding RPM changes. The RPM CHANGE displayed is the difference between the displayed BASE RPM reading and the active RPM reading.

When the emissions and vacuum options are installed, HC, O_2 and VACUUM readings will appear during manual power balance tests. The changes in these measurements may be observed when individual cylinders are shorted out. Refer to "Test Procedures" for power balance instructions.

Selection #4: Perform Calibration

One of two pages will appear when this menu selection is made.

a. If an emissions module **is not** installed, the CALIBRATION page (Figure 9), identical to the one that appears after the tester self-test/warm-up page, will be displayed. Refer to "Test Preparation" for instructions on how to automatically self-calibrate the analyzer.

b. If the emissions option **is** installed, a CALIBRATION MENU page (Figure 10) will be displayed. The menu contains four selections which detail gas calibration procedures. The CALIBRATION page discussed above is the first selection. Refer to "Maintenance and Service" for details on gas calibration.

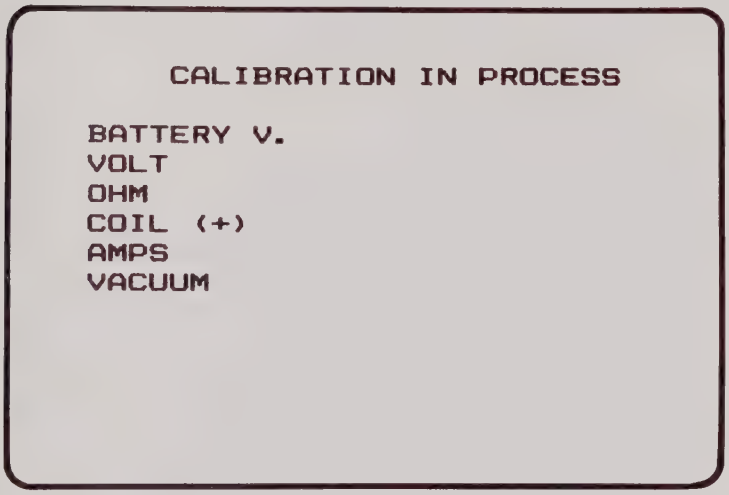


*Figure 9. If an emissions module is **not** installed, this page appears when selection four is made on the PROGRAM MENU page.*

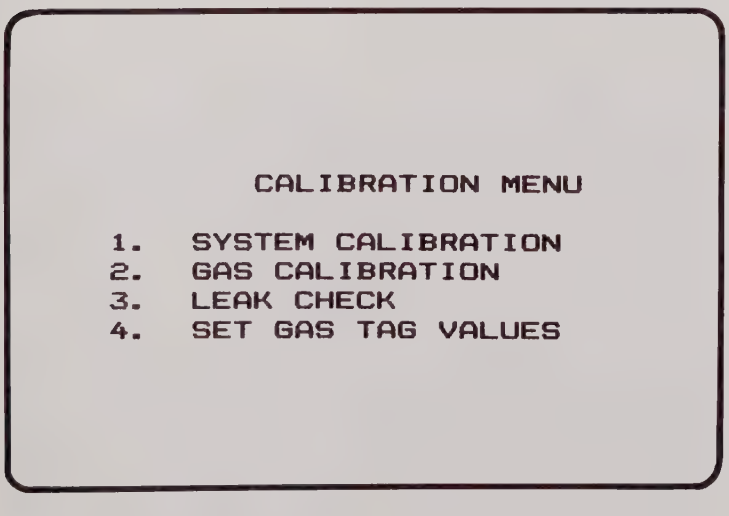


*Figure 10. If an emissions module **is** installed, this page appears when selection four is made on the PROGRAM MENU page.*

Selection #5: Data Link

When this menu selection is made and the Data Link option is installed, the DATA LINK TITLE page will be displayed (Figure 10a). If the option is not installed, NOT ACTIVE will appear next to the main menu selection.

The Data Link module has a 3.5 inch floppy disk drive into which hard-shell magnetic disks are inserted. The disks contain individualized programs for testing Ford, Chrysler and GM on-board computers.

The Data-Link on-board computer test programs are separate from the analyzer's engine test functions; however, the remote control allows the technician to alternate between the two if desired and all Data Link pages are displayed on the VDU.

Refer to "On-Board Computer Testing" for further instructions and details.

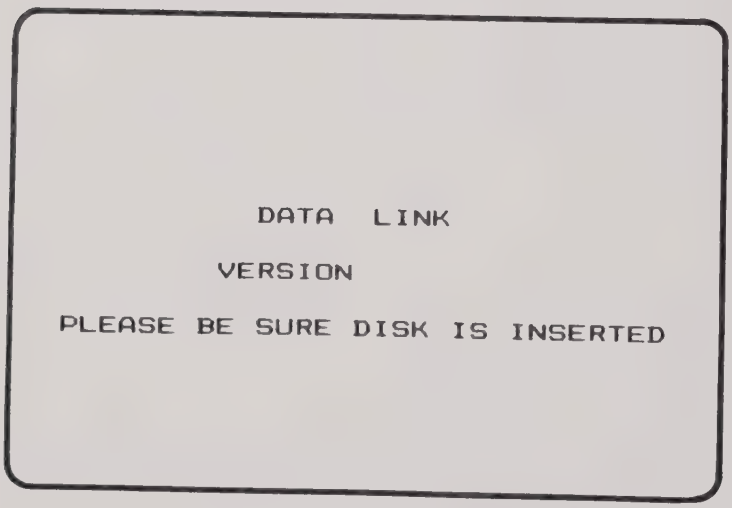


Figure 10a. Data Link Title Page.

Oscilloscope

The scope (Figure 11) is capable of displaying primary and secondary circuit patterns, in display, raster and superimposed modes of waveform display. A millisecond time sweep and pinpoint mode may also be selected.

When the scope is in the display mode, individual cylinder waveform(s) may be expanded and positioned at the millisecond scale line by pressing the cylinder's corresponding key number.

With the exception of front-panel adjustment controls for scope brightness, position, and spacing, the scope is operated entirely with the remote control. Anytime a scope control key is pressed, the setting will appear for a short time in reverse video at the bottom of the VDU (Figure 12).

Refer to "Instruments and Controls" and "Test Procedures" for detailed information on scope operation and testing.

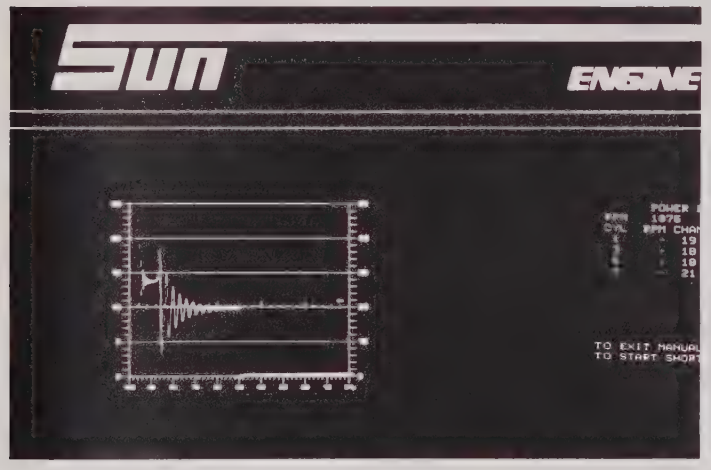


Figure 11 shows a 5 MSEC time sweep. The other available modes of waveform display are display, raster, superimposed and special. The scope is operated with the remote control.

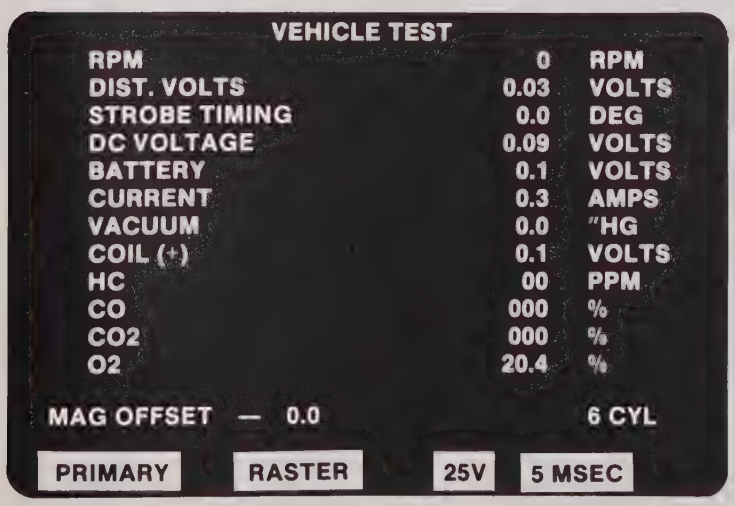


Figure 12. Scope settings appear for a short time in reverse video on the VDU.

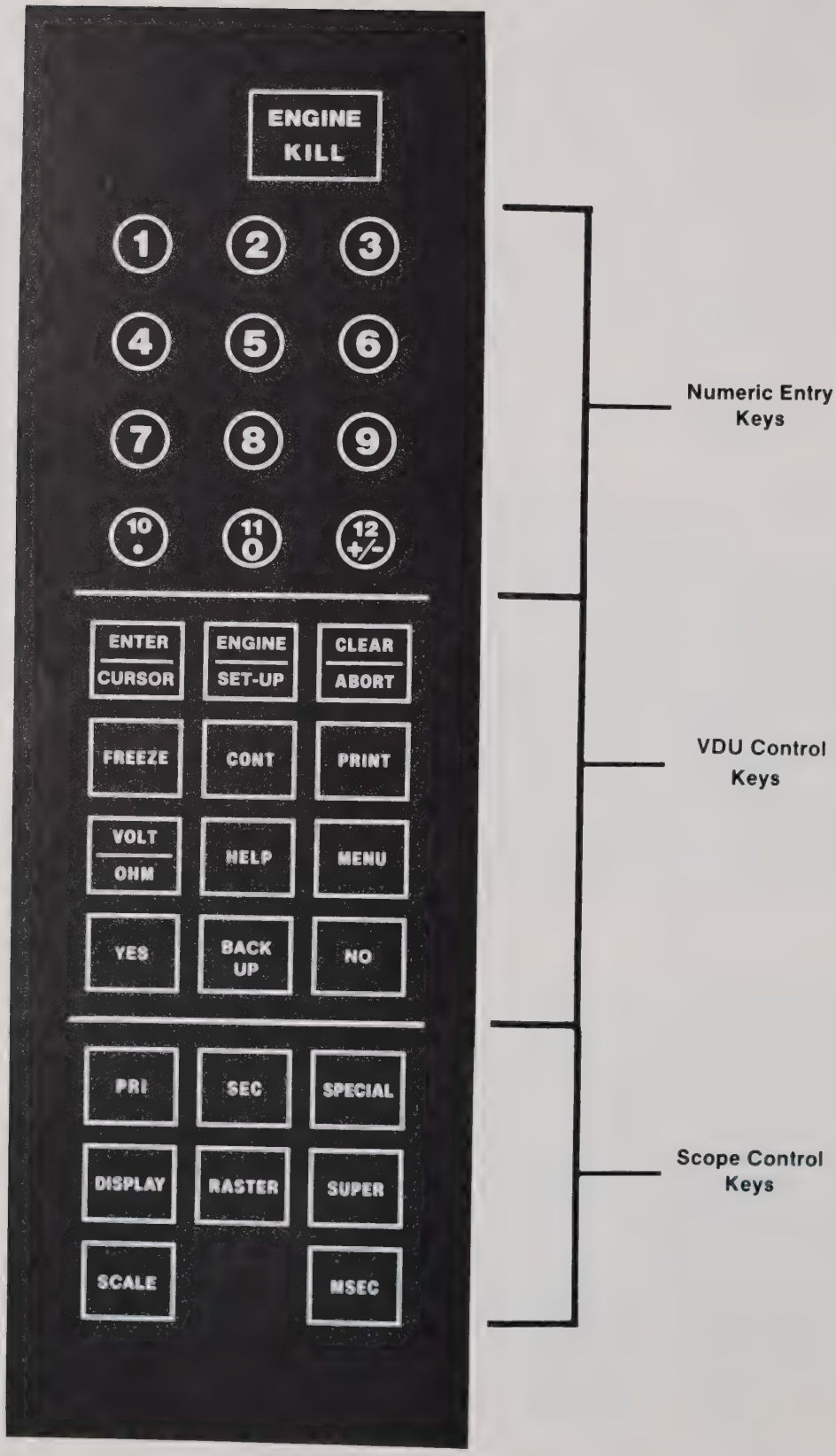


Figure 13. Remote Control

CONTROLS

REMOTE

The remote control keypad (Figure 13) is divided into three basic sections: numeric entry, VDU control, and scope control. An engine kill key is located in the upper right hand corner of the remote control.

ENGINE KILL — Press this key to electronically disable the engine (i.e. in emergency situations to stop the engine or to perform cranking tests). Press again to release. When ENGINE KILL is on, a status indicator will be displayed on the VDU.

Numeric Entry Keys

Numeric entry keys are used to make menu selections, enter numerical data, and to select a specific cylinder (i.e. for power balance or scope display). The function of the key depends on the page displayed. For example, a numeric key pressed on a power balance page will short out a cylinder. On the VEHICLE TEST page, a numeric key pressed will select a cylinder for expanded view on the scope.

NOTE: The ten (10), eleven (11) and twelve (12) functions cannot be used for numeric entries. For example, a number of cylinder entry for a 12 cylinder car is accomplished by pressing "1" then "2".

1 — 9 Press these keys to make number entries and select cylinders.

10 . Dual-function. Use the decimal point with numeric entry keys on the data entry pages; press "ten" to select the number (i.e. cylinder selection on scope control or power balance page).

11 0 Dual-function. Use the zero with numeric entry keys on the data entry pages; press "eleven" to select the number (i.e. cylinder selection on scope control or power balance page).

12 +/- Multi-function. Select plus or minus sign by pressing this key successively when required on data entry pages. Press "twelve" to select the number (i.e. cylinder selection for scope control or power balance page). Select trigger polarity in pinpoint mode by pressing this key successively.

VDU Keys

VDU control keys are used to change VDU pages; to clear, print or freeze VDU data; and to select VDU pages (HELP, MENU or SET-UP).

ENTER / CURSOR Dual-function. Use cursor on data entry pages to move the cursor down the page to the next data entry line. Use enter after making a correct numeric selection whenever the word "Enter" is displayed at the bottom of the VDU in the Data Link program.

ENGINE / SET-UP Dual-function. Use set-up to advance directly to the VEHICLE SET-UP page from MEA pages. Use engine to advance directly to the VEHICLE TEST Page from Data Link pages.

CLEAR / ABORT Press this key to erase data prior to repeating tests or to clear a data entry field.

FREEZE — Press this key to stop the automatic update of data on the VEHICLE TEST page and "freeze" the data for analysis. Pressing FREEZE a second time reactivates the screen and discontinues the status indicator on the VDU.

CONT — Press the continue key when prompted. It is typically used to leave a test page, start a test, or return from HELP or VEHICLE SET-UP pages.

PRINT — Dual function. 1) To print out any individual data page, press the key ONCE. There will be momentary pause before the printer begins to print out the information which appears on the VDU page, except the prompt messages at the bottom.

2) To form feed the printer paper to the next top of form (perforation), press this key TWICE in rapid succession. Refer to the printer operation section for instructions on setting the top of form.

VOLT / OHM — Press this key successively to change the display of VOLTS to OHMS and back again on the VEHICLE TEST page.

HELP — Press this key for help in setting up the vehicle, setting up the tester or operating the tester. Refer to the "Overview" for more details.

MENU — Press this key to return to the previous MENU page.

YES — Press this key to answer "Yes" to a (YES/NO) question displayed on the VDU in the Data Link program.

NO — Press this key to answer "No" to a (YES/NO) question displayed on the VDU in the Data Link program.

BACK UP — Press this key to review data or test results on a previous Data Link page. Refer to the backup function section for a detailed explanation of this feature.

Scope Keys

The scope control keys are used to select the type of waveform display and the scale to be read. Once selected, these settings are displayed for a short period of time at the bottom of the VDU.

NOTE: Upon power-up, the scope is automatically pre-set to display a primary circuit waveform in the display mode and high scale range.

PRI — Press this key to display a PRIMARY circuit waveform on the scope.

SEC — Press this key to display a SECONDARY circuit waveform on the scope.

DISPLAY

Press this key to display all the cylinder waveforms in a horizontal row across the scope. The number one cylinder spark line is displayed at the left of the scope with the remainder of the cylinder waveforms displayed in firing order sequence from left to right. The display will end with the firing line of the number one cylinder on the right. By pressing the appropriate key, a secondary or primary DISPLAY waveform may be viewed on the scope. Figures 14 and 15 show examples of these waveforms.

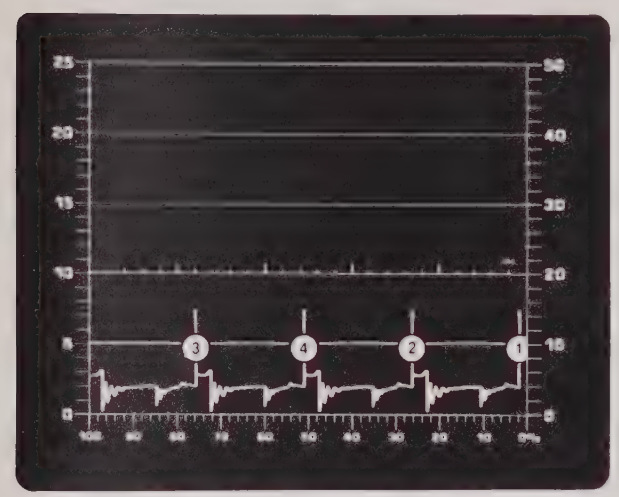


Figure 14. Secondary Display Pattern (Engine firing order 1-3-4-2).

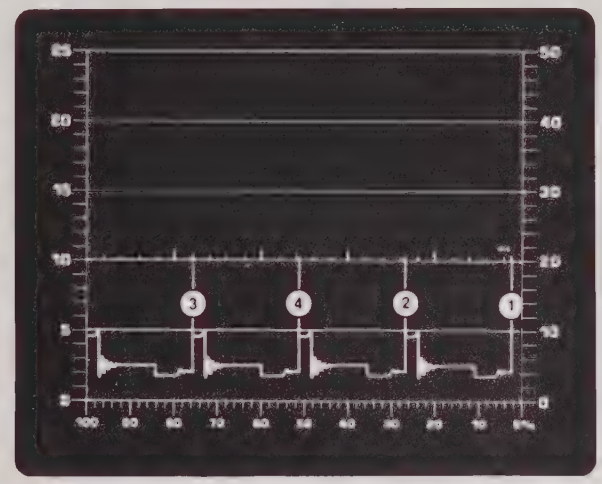


Figure 15. Primary Display Pattern (Engine firing order 1-3-4-2).

Cylinder Select

In the DISPLAY mode, the operator may press a cylinder's number on the remote control and display that cylinder in an expanded sweep above the other cylinders. The cylinder selected will be increased in size and appears in the center of the scope. Pressing the selected keypad number again returns that cylinder's waveform back into the original firing sequence.

One or more cylinders at a time can be selected. Patterns are then overlayed, similar to SUPERIMPOSED. Pressing the DISPLAY key cancels the cylinders chosen and returns the waveforms to the original firing sequence. Figures 16 and 17 show examples of secondary and primary waveforms with cylinders selected.

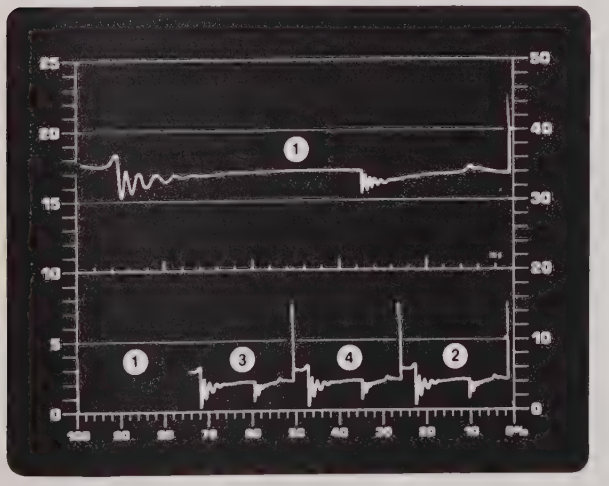


Figure 16. Secondary Display Pattern with Cylinder No. 1 selected. (Engine firing order 1-3-4-2).

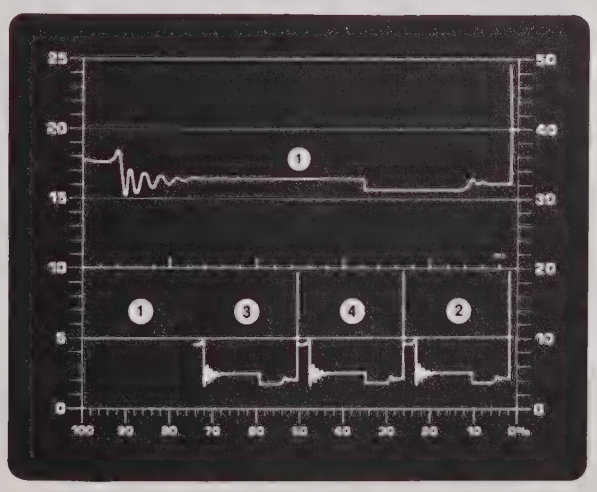


Figure 17. Primary Display Pattern with Cylinder No. 1 selected. (Engine firing order 1-3-4-2).

RASTER

Press this key to display each cylinder waveform one above the other at full screen width. A RASTER display consists of the cylinder number one waveform displayed at the bottom of the scope with the other waveforms displayed one above the other in firing order sequence. By pressing the appropriate key on the remote, a secondary or primary RASTER waveform may be viewed on the scope. Figures 18 and 19 show examples of these waveforms.

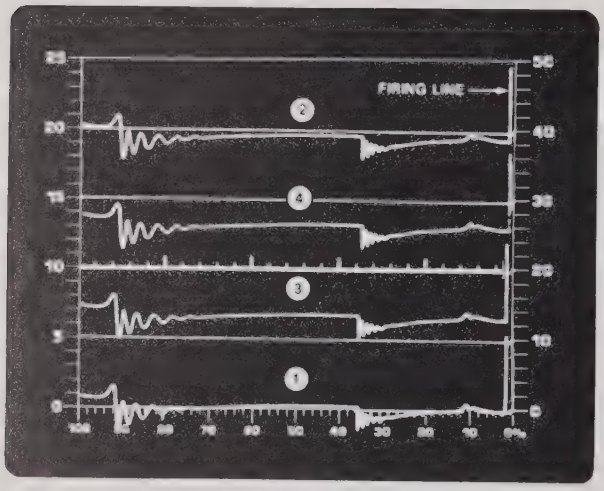


Figure 18. Secondary Raster Pattern

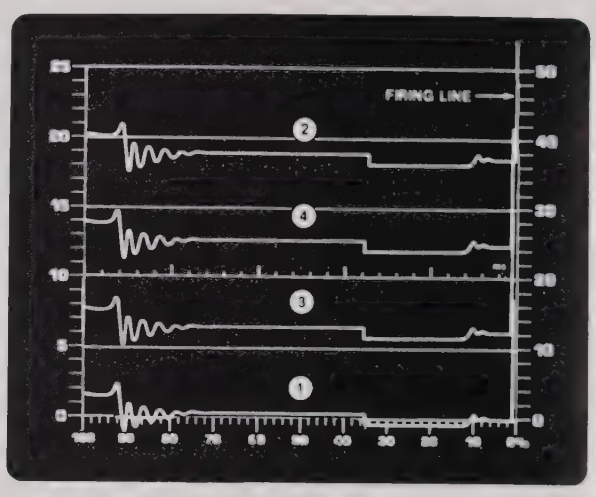


Figure 19. Primary Raster Pattern

The raster spacing control on the front panel (See "Controls") can be used to change spacing between individual cylinders. Individual cylinder select is not available in this mode.

Pressing the SPECIAL key in the RASTER mode displays an alternator output pattern on the scope. Figure 20 shows an example of this waveform.

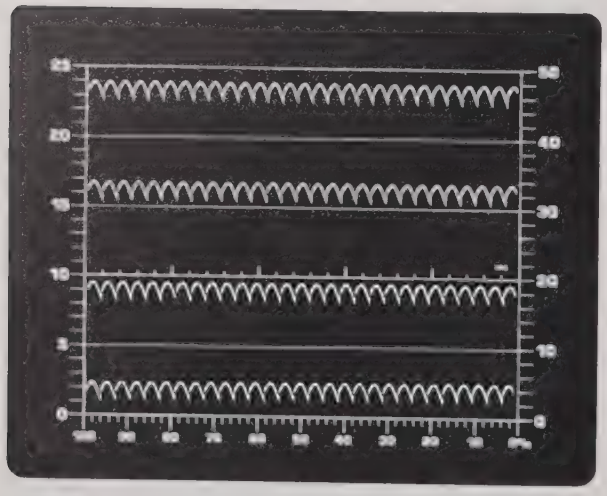


Figure 20. Alternator Raster Pattern

SUPER Press this key to display a SUPERIMPOSED pattern, which places all the cylinder waveforms one on top of the other. By pressing the appropriate key, a secondary or primary SUPERIMPOSED pattern may be viewed on the scope. Figures 21 and 22 show examples of these patterns.

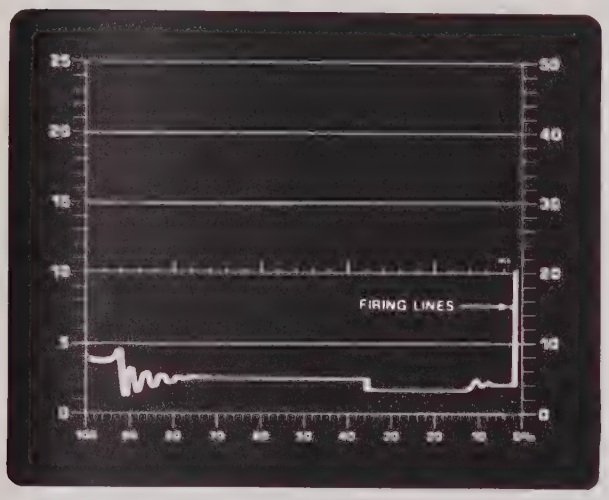


Figure 21. Primary Superimposed Pattern

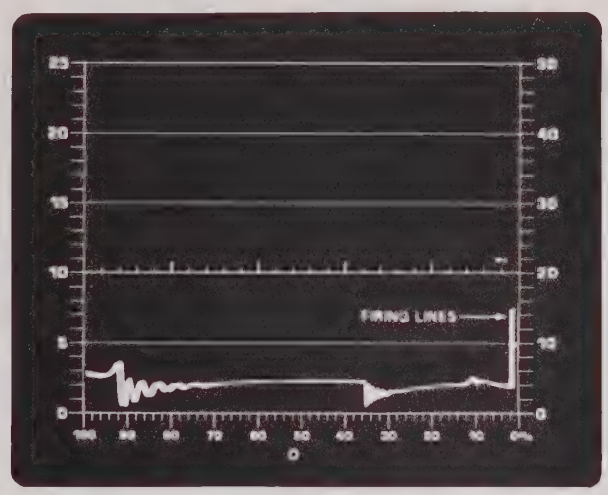


Figure 22. Secondary Superimposed Pattern

MSEC Press this key to display the first five milliseconds of the waveform selected; twice to display a 25 millisecond time period; and three times to display a 100 millisecond time period.

In DISPLAY mode, the cylinder select feature is used with the 5 MSEC sweep to show the first five milliseconds of the selected cylinder. Refer to Figure 23 for an example. In RASTER and SUPERIMPOSED modes, **all** cylinders will be displayed with the five millisecond sweep rate.

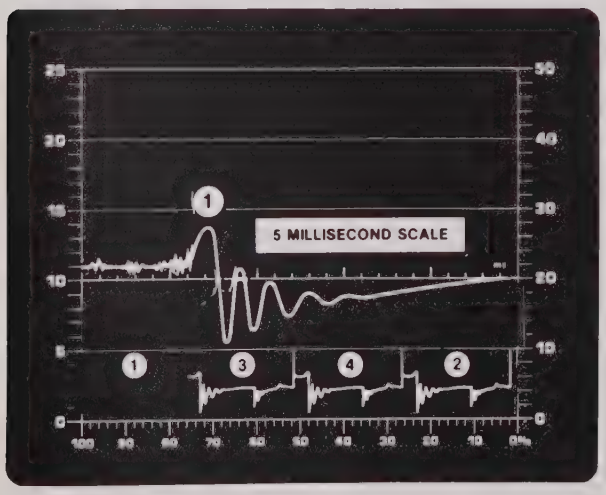


Figure 23. 5 MS Sweep with Cylinder No. 1 selected

SCALE

Press this key successively to change the range of the displayed scope pattern. The selection made will appear in reverse video on the VDU.

Primary circuit waveforms are displayed in either 0 to 500 volts using the right scale, or 0 to 25 volts using the left scale.

Secondary circuit waveforms are displayed in either 0 to 50 kilovolts using the right scale or 0 to 25 kilovolts using the left scale.

Special circuit waveforms are displayed in either 0 to 5 volts or 0 to 25 volts using the left scale; and 0 to 50 volts using the right scale.

Refer to the "Scales" section for more details.

SPECIAL

Press this key once to display an alternator output waveform (signaled from Red battery (+) lead) on the scope. Press it twice to enter pinpoint mode.

Pinpoint Mode

Pinpoint mode allows signals from components such as fuel injectors, M/C solenoids and O_2 sensors to be displayed and measured using the MEA's scope and the VEHICLE TEST page. The VOLT-OHM leads must be connected to the desired component to receive a signal and display a waveform.

The pinpoint test mode is entered by twice depressing the SPECIAL key on the MEA remote control. The scope will automatically display a SUPERIMPOSED waveform pattern received from the VOLT-OHM leads. The second line of the VEHICLE TEST page will display the signal's duty cycle and frequency as expressed in percent and Hertz (Hz).

Three vertical voltage scales (5V, 25V, 50V) can be selected sequentially by pressing the SCALE key on the remote control. Three horizontal time sweep scales (5 MSEC, 25 MSEC and 100 MSEC) can be selected sequentially by pressing the MSEC key. Refer to the control chart for details.

NOTE: Connect the VOLT-OHM leads in parallel across the circuit to be tested.

```
              VEHICLE TEST
RPM                          797   RPM
SPECIAL    21.6 %           66.7   HZ
STROBE TIMING               18.3   DEG
DC VOLTAGE                 12.89   VOLTS
BATTERY                     13.8   VOLTS
CURRENT                      0.2   AMPS
VACUUM                       0.0   "HG
COIL (+)                (NOT ACTIVE)
HC                      (NOT ACTIVE)
CO                      (NOT ACTIVE)
O2                      (NOT ACTIVE)
CO2                     (NOT ACTIVE)

MAG OFFSET  -    0.0                8 CYL

PINPT —     SUPER          50V     5 MSEC
```

Pinpoint test mode settings will appear for a short time in reverse video at the bottom of the VDU, including the mode, trigger, polarity, vertical scale and horizontal scale. The second line of the VDU will show signal duty cycle and frequency readings.

PINPOINT TEST MODE CONTROL

FUNCTION	KEY	SELECTIONS	NOTES
Select Pinpoint Test Mode	SPECIAL	1) Twice To Enter 2) Once To Exit	In the normal SUPERIMPOSED Mode, if the time between adjacent signals is less than 5 MSEC, multiple patterns will appear on the scope similar to DISPLAY Mode.
Select Vertical Scales	SCALE	5V 25V 50V	Trigger Voltage Threshold Minimums: 1V 5V 10V
Select Horizontal Sweep Rate	MSEC	5 MSEC 25 MSEC 100 MSEC	In the MSEC Mode, a full time period will be shown regardless of the number of pulses which may appear during that time.
Select Trigger Polarity	12 +/-	+: Triggers on signal rising edge -: Triggers on signal falling edge	The scope will not trigger on signals below 0 volts unless the polarity switch, on the rear of unit, is put in the Positive position; or the VOLT-OHM leads are reversed.

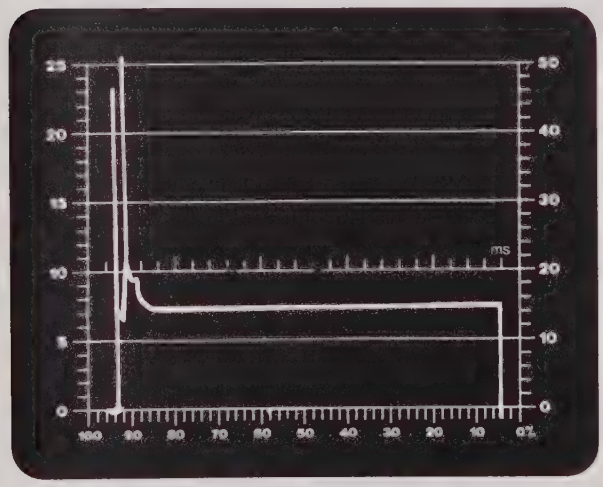


FIGURE 23a. Fuel Injector Waveform (GM TBI) using 50V scale.

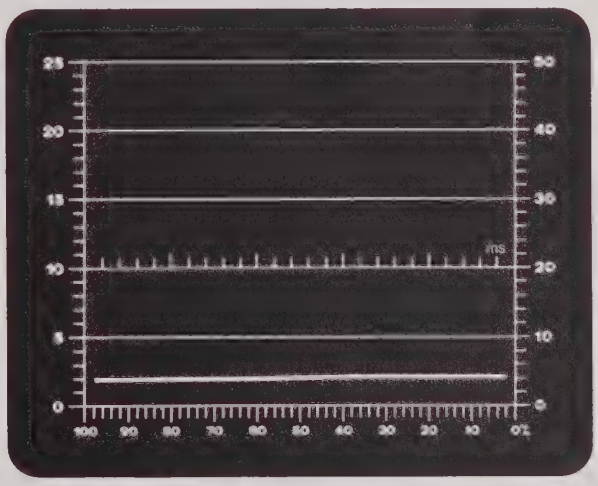


FIGURE 23b. O_2 Sensor Waveform using the 5V scale.

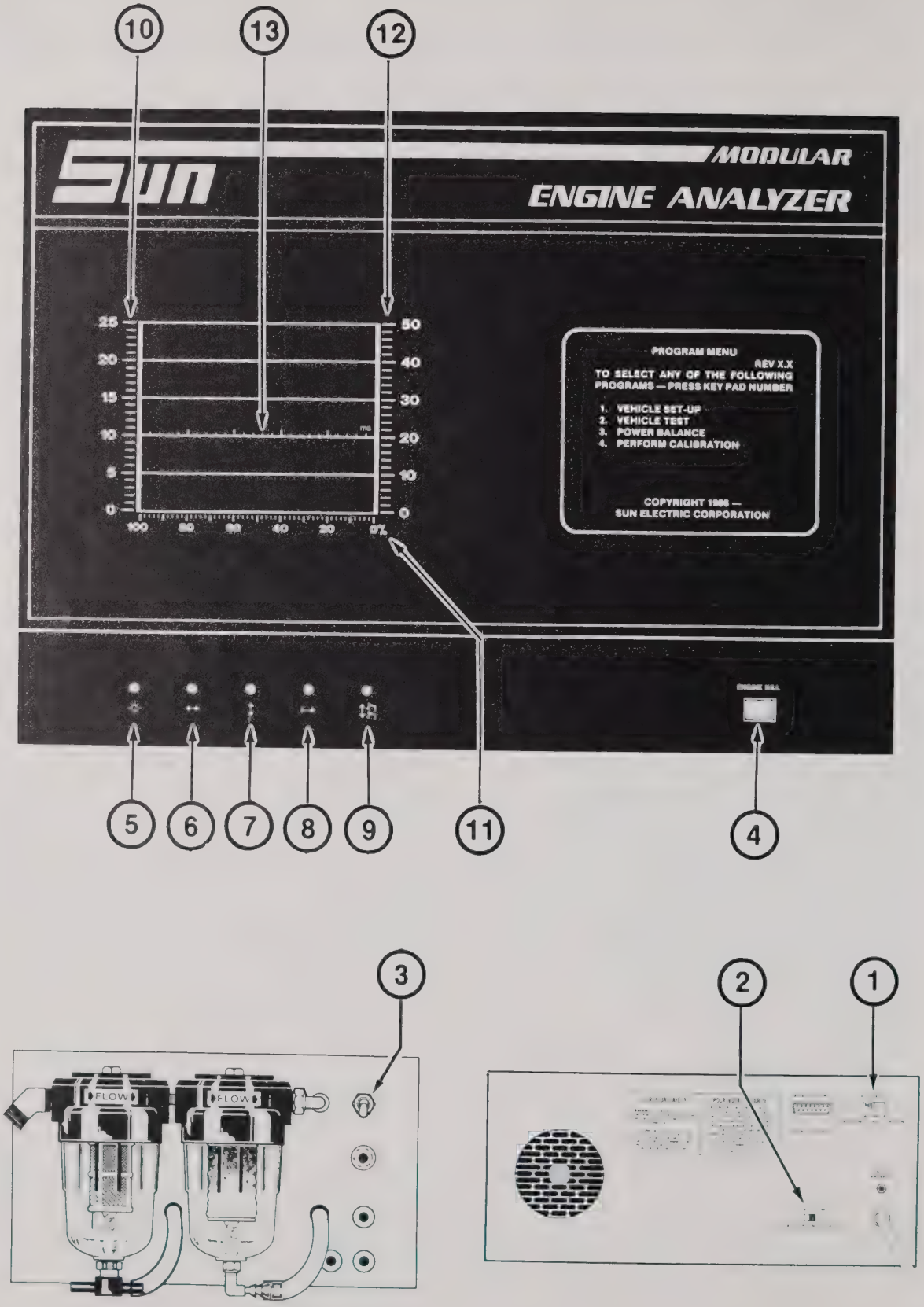


Figure 24. Tester-Mounted Controls and Scales

FRONT-REAR PANEL CONTROLS and SCALES (Figure 24)

Operational

Basic operational controls on the front and rear of the unit include:

Rear

1. ON/OFF SWITCH—Three-position switch (Tester ON — Tester OFF — Light ON) on tester rear panel is used to power tester and turn the head sign light on.

2. VEHICLE GROUND POLARITY SWITCH—Two-position switch (Negative Ground/ Positive Ground) located on the rear panel. Be sure switch is in proper position before testing ("positive" for positive ground systems and "negative" for negative ground systems). Most vehicles are negative ground.

3. PUMP—Two-position switch (Operate/Gas calibrate) on rear panel above the filters. Turn this switch to OPERATE when testing with the optional emissions package. Turn off when not in use to extend pump and filter life.

Front

4. ENGINE KILL—Momentary switch on analyzer front panel duplicates the engine kill function on the remote.

Front Panel Scope Adjustments

The following controls on the tester front panel are used to adjust scope patterns:

5. -☼- BRIGHTNESS—adjusts the intensity of the pattern shown on the scope.

6. ↔ HORIZONTAL POSITION—adjusts the position of the pattern on the scope, left to right.

7. ↕ VERTICAL POSITION—adjusts the position of the pattern on the scope, up or down.

8. ⊢→ SWEEP LENGTH—adjusts the horizontal length of the pattern.

9. RASTER SPACING—adjusts the spacing of the individual cylinder patterns, when the RASTER display is selected.

Scope Scales

The scope displays ignition and charging system waveforms on all test pages and utilizes three scales to measure voltage and dwell in the primary and secondary circuits. The four scales are:

10. 0 to 25 VERTICAL-LEFT SCALE. The 0 to 25 vertical-left scale is divided into increments of 1 kilovolt with a range of 0 to 25 KV (1 KV = 1000V) for secondary circuit testing. When testing the primary circuit, the scale is divided into increments of 1 volt with a range of 0 to 25V.

    This scale is to be used if "25V" or "25KV" is displayed in reverse video on the VDU after pressing the SCALE key on the remote control. In pinpoint mode, this scale is to be used if "5V" or "25V" is displayed in reverse video on the VDU after pressing the SCALE key.

11. PERCENT OF DWELL SCALE. The percent of dwell scale is divided into 50 increments of two percentage points from 0 to 100.

12. 0 to 50 VERTICAL-RIGHT SCALE. The 0 to 50 vertical-right scale is divided into increments of 2 kilovolts with a range of 0 to 50 kV for secondary circuit testing. When testing the primary circuit, the scale is divided into increments of 20 volts with a range of 0 to 500v. (1KV = 1000v).

    This scale is to be used if "500V" or "50 KV" is displayed in reverse video on the VDU after pressing the SCALE key on the remote control. In pinpoint mode, this scale is to be used if "50V" is displayed in reverse video on the VDU after pressing the SCALE key.

13. MS SCALE. The millisecond (MS) scale is divided into five major increments. When the 5 MS scale is selected, each represents 1 millisecond; with the 25 MS scale, 5 milliseconds; and with the 100 MS scale, 25 milliseconds. Each of the five major divisions are further divided into 5 smaller increments each representing 0.2, 1, or 5 milliseconds (millisecond = 1/1000 of a second), depending on the scale selected.

    The MSEC scale is selected by pressing the MSEC key on the remote control.

TEST PREPARATION

Self-Test/Warm-up

1. Plug the tester power cord into the proper power outlet. See the nameplate on the tester for power requirements.

2. Push the three-position AC power switch (tester ON, tester OFF, light ON) to the tester ON position (Figure 24). A title page (Figure 25), with a copyright notice and software version number, will be displayed upon power-up.

3. If the printer option is installed, align the paper perforation with the cutting edge of the printer cover by turning the platen knob.

4. Press CONT to display the Self-Test/Warm-up page (Figure 26). The analyzer will then perform an automatic self-test with the message SELF TEST OK appearing if no problems are sensed. If a system fault is detected, a message describing the fault appears.

5. If the 4-gas option is installed, a 15-minute warm-up timer will be displayed. If the CONT key is pressed before the warm-up is complete, the tester will calibrate all items except HC, CO, and CO_2. Testing of the vehicle may begin, but readings of these gases will not appear. Repeating the calibration process fifteen minutes later will allow gases to calibrate.

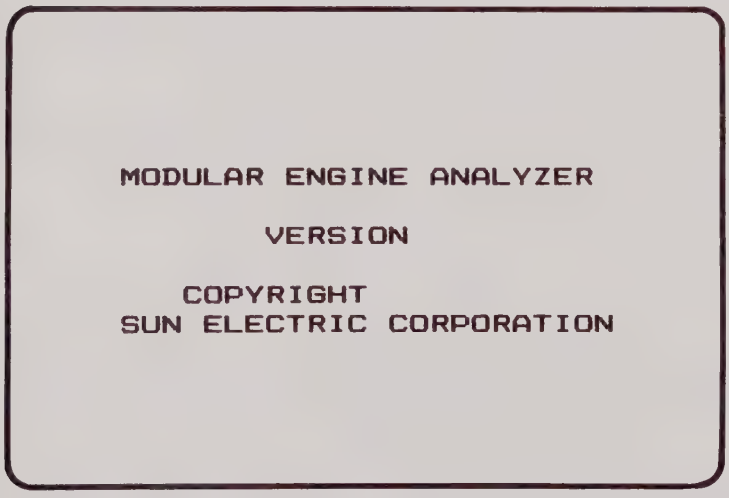


Figure 25. This is first page the operator will see after the engine analyzer is turned on.

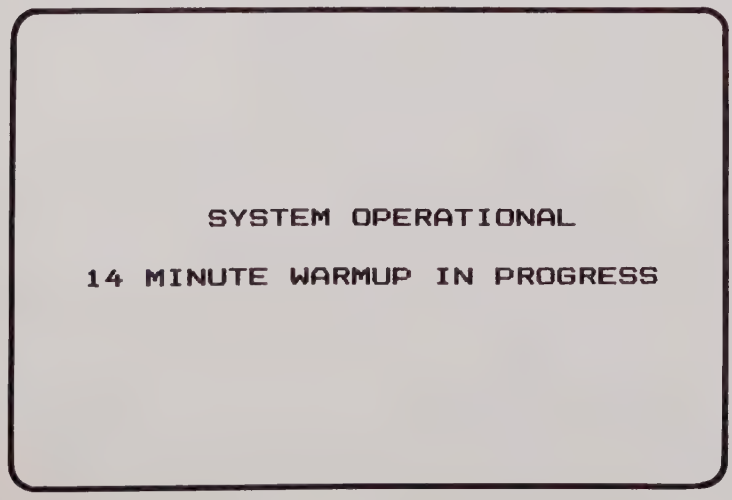


Figure 26. "System Operational" means the analyzer has passed its self-test and everything is in working order. The warm-up timer only appears if the emissions module is installed.

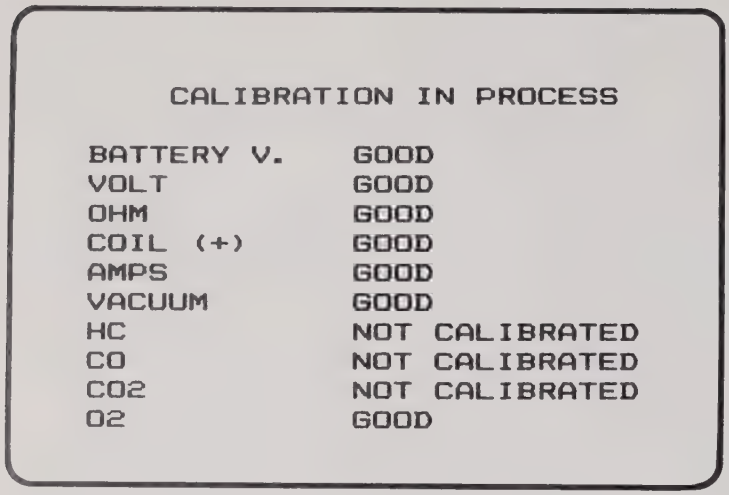


Figure 27. "Good or "Service Required" or "Not Calibrated" will appear next to each item as the analyzer electronically calibrates itself. The HC, CO and CO_2 readings will not calibrate until the 15-minute warmup is complete.

Calibration

5. Press the CONT key. The CALIBRATION page (Figure 27) will be displayed. Short the volt-ohm leads together (reference Figure 29). The message SHORT VOLT/OHM leads will flash on and off on the VDU until this is done. Do not attempt tester calibration while the test leads are attached to a vehicle. Incorrect calibration will result. (Optional items not installed will not be displayed on this page.)

6. The tester will automatically self-calibrate all items displayed in Figure 27, displaying GOOD or SERVICE REQUIRED next to each parameter. The calibration may be re-started at any time by pressing the CLEAR/ABORT key.

7. When calibration is complete, the message PRESS MENU or CONT will appear at the bottom of the VDU.

Vehicle Setup

8. The tester is automatically set up for 4-cylinder, 4-cycle engines with 0.0 magnetic offset angle. If these set-up specifications do not need to be altered, the operator may proceed directly to the VEHICLE TEST page by pressing the CONT key. If the vehicle set-up does need to be changed, the operator may select the VEHICLE SET-UP page (Figure 28) by pressing the SET-UP Key.

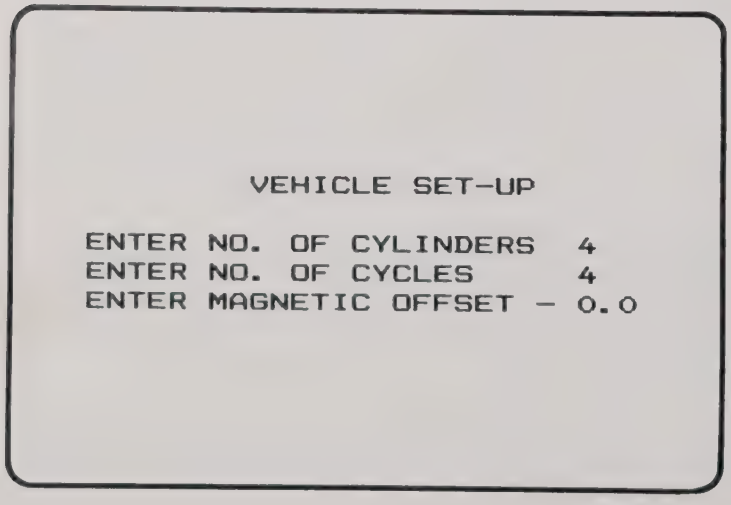


Figure 28. The engine analyzer is automatically preset for these vehicle specifications.

To change the test parameters, press the CURSOR key to advance the cursor to the data line which is to be changed, then press the CLEAR/ABORT key. Enter the new data using the numeric keys. If the entry flashes on the screen, it is out of limit. Check the number and re-enter.

Lead Connections

9. Connect the test leads with the **engine off** (Figure 29) as follows:

   a. If the vehicle being tested is equipped with a magnetic timing probe receptacle, install the mag probe in the receptacle, with adapter if required. Refer to "Accessories".

   b. If the vehicle does not have a mag probe or the magnetic timing option is not installed, check timing with the timing light. Clean the crankshaft pulley and timing pointer. Use a piece of chalk or white touchup paint to paint the Zero Degree Line on pulley and pointer for visibility.

   c. Turn the timing advance knob on the timing light fully counterclockwise (off) until it clicks. Then place the on/off button in the "off" position (white dot out).

   d. Clamp the BLUE—booted primary connector to the TACH or (-) coil terminal.

   e. If coil (+) option is installed, clamp the YELLOW-booted connector (BLACK twinflex lead) to the positive terminal of coil. Both the coil (-) and coil (+) connectors will be part of a single BLACK twinflex lead.

   f. Clamp the CHROME pattern pickup (BLUE lead) around the coil high-tension wire.

      NOTE: If system does not have a coil high-tension wire, Sun options are needed, for example, the HEI adapter. Refer to "Accessories".

   g. Clamp the RED-booted connector (BLACK twinflex lead) to the positive battery terminal.

   h. Clamp the BLACK-booted connector (BLACK twinflex lead) to the negative battery terminal.

   i. If the vacuum/amps option is installed, clamp the GREEN ammeter pickup around the negative battery cable (around all wires if there is more than one) with the arrow on the pickup pointing away from the battery.

   j. Clamp the RED trigger pickup (RED lead) around the number one spark plug as close to the distributor cap as possible.

   k. If the vacuum/amps option is installed, connect the vacuum hose to a direct source of engine vacuum. Do not connect to any other source such as ported vacuum or vacuum reservoir.

   L. If an emissions module is installed, disable the air pump to prevent catalytic converter action by clamping or pinching off the hoses or tubes at the air pump or engine. Some manufacturers recommend disconnecting and plugging the tubes leading from the air pump. Consult each manufacturer's specific recommendations.

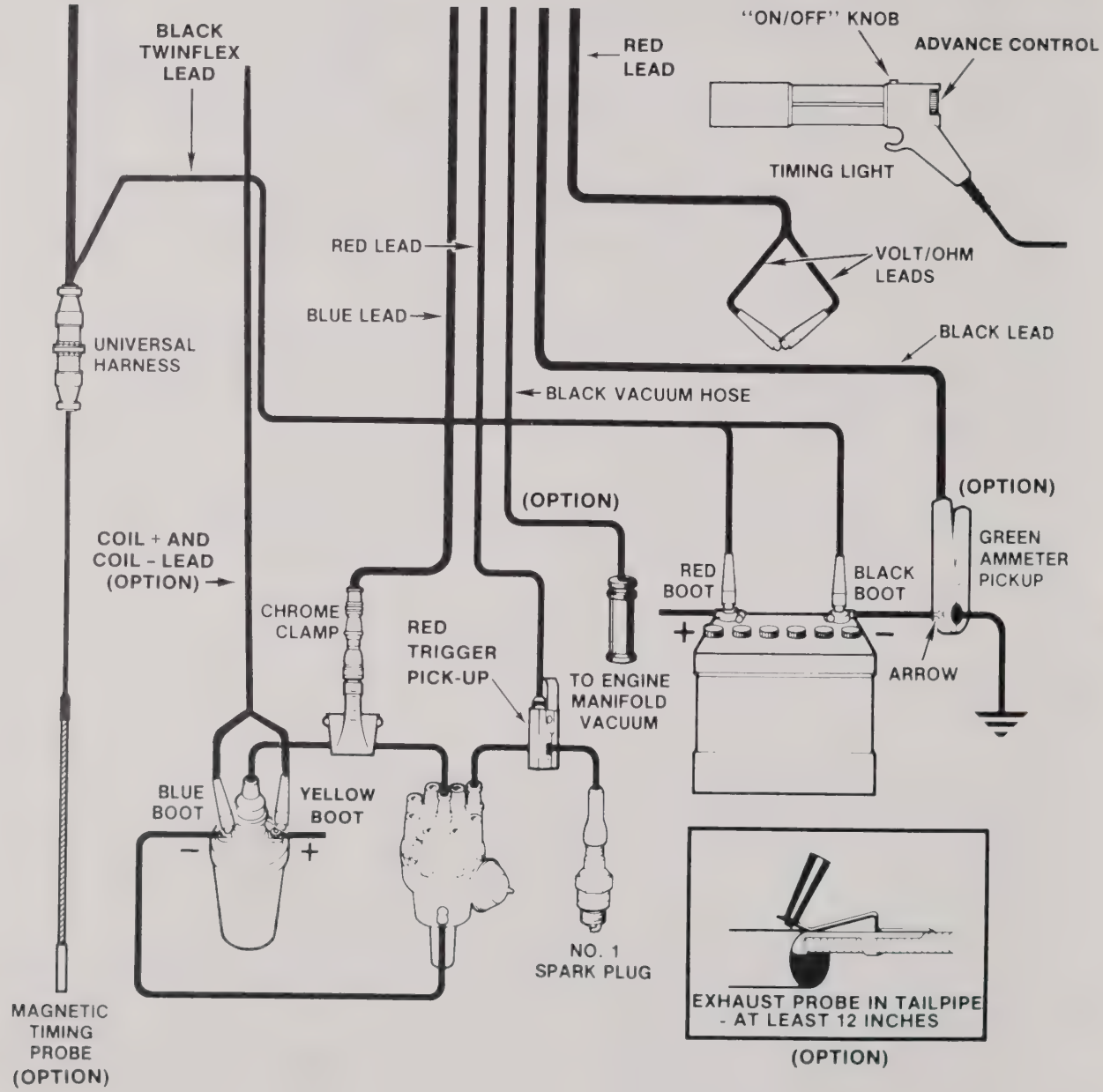


Figure 29. Tester Hookup to Vehicle

NOTE: If the coil (+) option is not installed, a single BLUE primary lead will be substituted.

1. Disable Pulse-Air systems to prevent catalytic converter action by plugging tubes at the air cleaner. Be sure to close off any air supply to the catalytic converter.

   NOTE: To prevent damage to air pump, close off hose after diverter valve.

2. Insert the sampling probe into the tailpipe, at least 12 inches.

3. Connect exhaust ventilation to the tailpipe.

4. Turn the two-position pump switch on the back of the tester to the OPERATE position.

m. Turn all vehicle accessories off.

n. Place the vehicle shift lever in PARK if it has an automatic transmission and set the parking brake; on vehicles with manual transmissions, place the shift lever in NEUTRAL and set the parking brake.

TEST PROCEDURES

The following section details a variety of tests which can be performed using the VEHICLE TEST page, the POWER BALANCE TEST page and the ignition oscilloscope. The tests may be used selectively to check for suspected problems or in their entirety to check overall engine performance.

STANDARD TEST PROCEDURE

The standard test procedure is a suggested sequence of engine tests performed under various operating conditions, including:

1) Key-off, engine-off
2) Key-on, engine-off
3) Cranking
4) High cruise
5) Low cruise
6) Idle
7) Snap acceleration
8) Power balance

The tests above are described on the following pages for both standard and optional MEA-1500 test capabilities. Be sure to note the capabilities of your MEA-1500 before proceeding with the tests.

1. Key-Off, Engine-Off Tests

CHECK BATTERY VOLTAGE AND CURRENT DRAW AS FOLLOWS:

a. Turn the engine off, close all the doors and turn off all the accessories.

b. Note the readings. The shaded areas on Figure 30 indicate which lines should be read.

c. If desired, press the PRINT key to record the results.

Test Mode	Test	Read	Test Indications — Good
Engine Off	Battery	VDU	12.4V or higher for 12-volt systems
Key Off	Current	VDU	Near 0

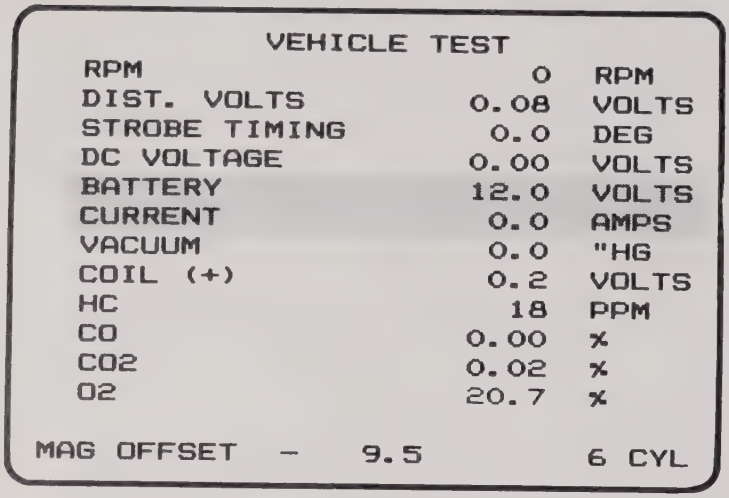


Figure 30. For the engine-off, key-off tests, read the fifth and sixth lines of the VDU.

2. Key-On, Engine-Off Tests

CHECK BATTERY VOLTAGE, CURRENT DRAW, COIL (+) AND DIST. VOLTS AS FOLLOWS:

a. Turn the ignition key to on, but do not start the engine.

b. Note the readings. The shaded areas on Figure 31 indicate which lines should be read.

c. If desired, press the PRINT key to record the results.

Test Mode	Test	Read	Test Indications — Good
Engine Off Key On	Dist. Volts	VDU	Depends on vehicle type
	Battery	VDU	12 Volts or higher
	Current	VDU	Depends on vehicle type
	Coil (+)	VDU	Close to battery voltage

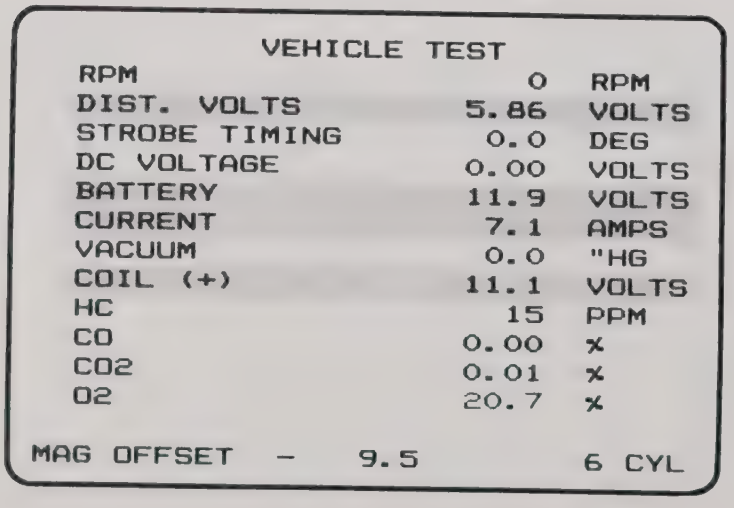


Figure 31. The Dist. Volts reading on the second line only appears when RPM is 0.

3. Cranking Tests

NOTE: Perform cranking tests under no-start and hard-start conditions. Where possible, the ENGINE KILL button should be used to prevent the engine from starting.

PERFORM CRANKING TESTS AS FOLLOWS:

a. If the engine is carbureted and the emissions module is installed, pump the accelerator once to insure that some fuel enters the engine to be sensed at the tailpipe. If the engine diesels, let the engine cool or pump the accelerator pedal several times before repeating the test.

b. Crank the engine until the test data stabilizes, but no longer than 15 seconds at a time.

c. If desired, press the FREEZE key to hold the cranking readings for analysis, or press PRINT to record them while the engine is cranking.

d. The shaded areas on Figure 32 indicate which lines should be read.

NOTE: If the four-gas option is installed, the appearance of LOW FLOW or PUMP OFF messages indicate that certain conditions should be corrected before proceeding. Turn the switch above the filters to the OPERATE position, or refer to "Maintenance And Service" to correct low flow.

Test Mode	Test	Read	Test Indications — Good
Cranking	RPM	VDU	Min. 140-300 (4 cyl.), 130-230 (6 cyl.), 120-200 (8 cyl.)
	Dwell	VDU	Refer to manufacturer's specifications
	Timing	VDU	Refer to manufacturer's specifications
	Battery	VDU	9.6 Volts or higher
	Current	VDU	Max. 210-280 (8 cyl.), 150-270 (6 cyl.), 120-220 (4 cyl.)
	Vacuum	VDU	1" or above and steady
	Coil (+)	VDU	Close to battery voltage
	HC	VDU	Carbureted — over 1000 Fuel injected — as low as 0

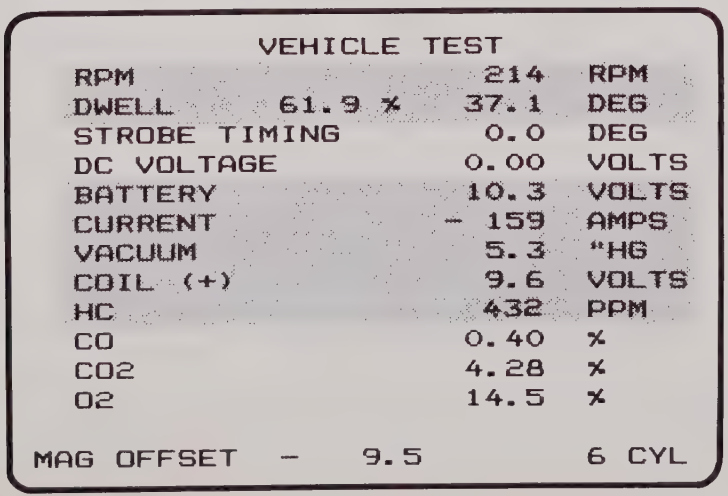


Figure 32. The Dwell reading on the second line appears when RPM is above zero. DC voltage on fourth line is only used for pinpoint tests.

4. High Cruise Tests

PERFORM THE VDU PORTION OF THE HIGH CRUISE TESTS AS FOLLOWS:

a. Accelerate the engine to approximately 2500 RPM (plus or minus 100 RPM) and maintain it for 15 to 20 seconds or until test data stabilizes.

b. If the magnetic timing option is installed, timing will be automatically displayed. The magnetic timing offset angle selected on the VEHICLE SET-UP page will be shown at the bottom of the VDU.

c. If the timing light is used, check the timing advance by setting the on/off switch on top of the timing light to the ON position. Then turn the timing advance control on the timing light clockwise until it clicks on. Point the timing light at the timing pointer, then turn the advance control until the mark on the crankshaft pulley lines up with the ZERO degree mark on the cover.

NOTE: On engines that have timing degree marks stamped in the timing chain cover, line up the mark on the crankshaft pulley with the ZERO degree mark on the cover.

d. After the above procedure, strobe timing in degrees will appear on the VDU.

e. When test data stabilizes, press the FREEZE key to hold the high cruise readings for analysis, or press PRINT to record them. The shaded areas on Figure 33 indicate which lines should be read.

PERFORM THE SCOPE PORTION OF HIGH CRUISE TESTS AS FOLLOWS:

a. Maintain 2500 RPM test speed while performing these scope tests:

1. **Alternator Condition**. Set the scope to RASTER mode and SPECIAL waveforms. Note the uniformity of the ripple waveform.

2. **Firing Voltage.** Set the scope to DISPLAY mode, 25 KV scale, and SEC waveform. Observe the voltage levels of the firing lines.

3. **Coil Oscillations**. Set the scope to RASTER mode and either PRI or SEC and either scope scale. Look for 4 or more gradually diminishing oscillations in the intermediate section of the waveform.

4. **Spark Duration**. Set the scope to RASTER mode and 5 MSEC waveform. Note the spark lines.

5. **Cylinder Timing**. Set the scope to SUPERIMPOSED mode and either PRI or SEC waveform, HIGH or LOW scale. Observe the point open or close signals for variation. On electronic ignition systems, the transistor off signals are to be observed for variation.

Test Mode	Test	Read	Test Indications — Good
High Cruise	RPM	VDU	2400 to 2600
	Dwell	VDU	Refer to manufacturer's specifications
	Timing	VDU	Refer to manufacturer's specifications
	Battery	VDU	13.2 - 15.6
	Current	VDU	5 or greater
	Vacuum	VDU	Higher than idle speed
	HC	VDU	Lower than low cruise HC
	CO	VDU	Lower than low cruise CO
	CO2	VDU	Same as low cruise CO2
	02	VDU	Higher than low cruise
	Alternator	Scope	See "Oscilloscope Testing"
	Firing voltage	Scope	See "Oscilloscope Testing"
	Coil oscillations	Scope	See "Oscilloscope Testing"
	Spark duration	Scope	See "Oscilloscope Testing"
	Cylinder timing	Scope	See "Oscilloscope Testing"

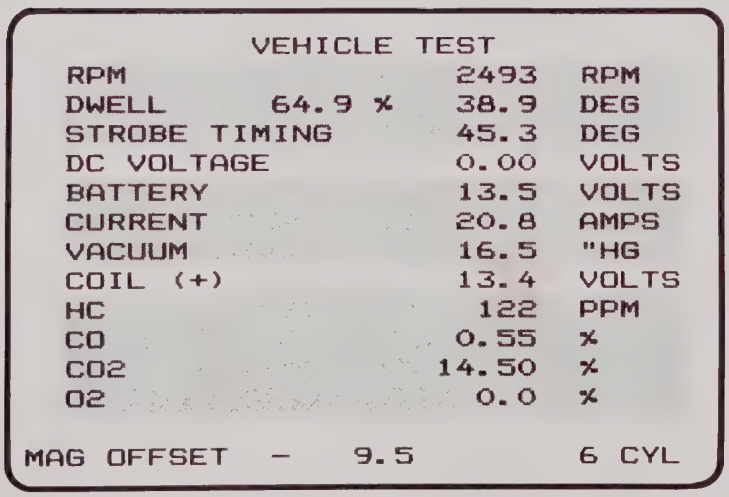


Figure 33. Line three will show a mag timing reading instead of strobe timing if the mag timing option is connected.

5. Low Cruise Tests

PERFORM THE LOW CRUISE TESTS AS FOLLOWS:

a. Accelerate the engine to approximately 1500 RPM (plus or minus 100 RPM) and maintain until HC and CO stabilize.

b. Repeat timing procedures from high cruise test.

c. When test data has stabilized, press the FREEZE key to hold the low cruise readings for analysis, or press the PRINT key to record them. The shaded areas on Figure 34 indicate which lines should be read.

Test Mode	Test	Read	Test Indications — Good
Low Cruise	RPM	VDU	1400 — 1600
	Dwell	VDU	Refer to manufacturer's specifications
	Timing	VDU	Refer to manufacturer's specifications
	Battery	VDU	13.2 — 15.6
	Current	VDU	Greater than 2.5
	Vacuum	VDU	Greater than idle
	HC	VDU	Lower than idle HC
	CO	VDU	Lower than idle CO
	CO2	VDU	Same as idle
	O2	VDU	Higher than idle

```
              VEHICLE TEST
RPM                        1488   RPM
DWELL        64.3 %        38.5   DEG
STROBE TIMING              31.0   DEG
DC VOLTAGE                 0.00   VOLTS
BATTERY                    13.5   VOLTS
CURRENT                    22.0   AMPS
VACUUM                     15.9   "HG
COIL (+)                   13.3   VOLTS
HC                          147   PPM
CO                         0.33   %
CO2                       14.36   %
O2                          0.0   %

MAG OFFSET  -    9.5             6 CYL
```

Figure 34. Low Cruise Test Results.

6. Idle Tests

PERFORM THE VDU PORTION OF THE IDLE TESTS AS FOLLOWS:

a. Check the vehicle manufacturer's recommended curb idle speed and set-up conditions and follow the recommended procedure.

b. Check the vehicle manufacturer's initial timing, speed and set-up conditions and follow the recommended procedure.

c. Bring the engine to the vehicle manufacturer's recommended initial timing speed (plus or minus 50 RPM), and repeat timing procedures.

d. When test data has stabilized, press the FREEZE key to hold the idle test readings for analysis, or press PRINT to record them. The shaded areas on Figure 35 indicate which lines should be read.

Perform the same tests which were done for HIGH CRUISE tests to complete the VDU portion of the IDLE tests.

Test Mode	Test	Read	Test Indications — Good
Idle	RPM	VDU	Curb idle per manufacturer's spec.
	Dwell	VDU	Refer to manufacturer's specifications
	Timing	VDU	Initial timing per manufacturer's spec.
	Battery	VDU	13.2 — 15.6
	Current	VDU	Minimum of 2
	Vacuum	VDU	Varies with altitude and vehicle type
	HC	VDU	See Chart
	CO	VDU	See Chart
	CO2	VDU	See Chart
	02	VDU	See Chart
	Coil polarity	Scope	See "Oscilloscope Testing"
	Firing voltage	Scope	See "Oscilloscope Testing"
	Coil oscillations	Scope	See "Oscilloscope Testing"
	Spark duration	Scope	See "Oscilloscope Testing"
	Cylinder timing	Scope	See "Oscilloscope Testing"

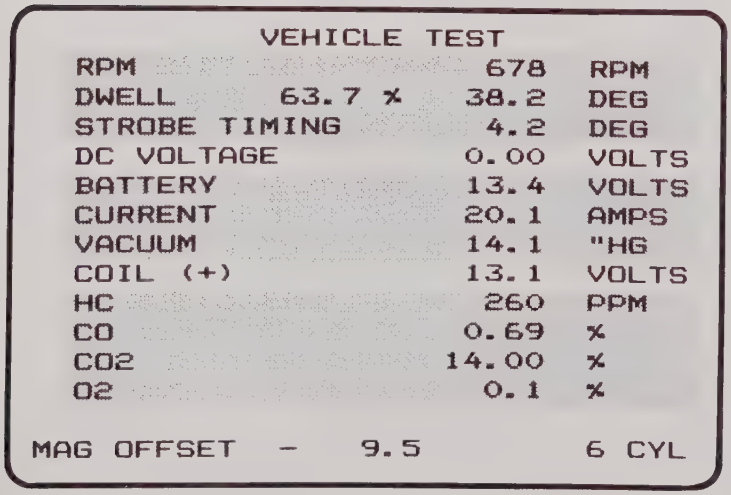


Figure 35. Idle Test Results.

VEHICLE YEAR	HC(ppm) LESS THAN	CO_2(%) GREATER THAN	CO(%) LESS THAN	O_2(%) IN THE RANGE OF
71-75	400 ppm	10%	3%	1%
76-79	300 ppm	11%	2%	2%
80-83	200 ppm	12%	1%	3%
84-86	150 ppm	13%	.5%	4%

7. Snap Acceleration Tests

PERFORM THE SNAP ACCELERATION TESTS AS FOLLOWS:

a. Set the scope to DISPLAY mode, SEC waveform and 25 KV scale.

b. Snap accelerate the vehicle by rapidly pushing the accelerator to the floor and releasing it.

c. Observe the voltage levels of the firing lines on the scope.

d. Press FREEZE to hold the snap acceleration readings for analysis, or press PRINT to record them. The shaded area on Figure 36 indicates which line should be read.

Test Mode	Test	Read	Test Indications — Good
Snap Acceleration	Firing voltage under load	Scope	See "Oscilloscope Testing"
	CO Change	VDU	Minimum increase of 1%

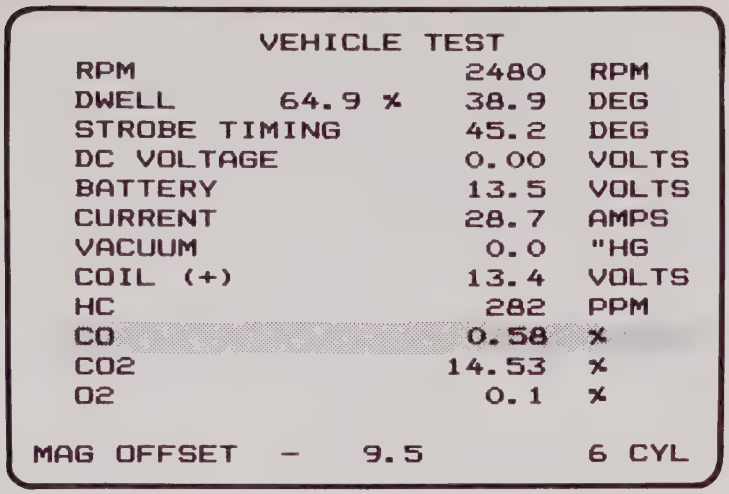


Figure 36. Snap Acceleration Test Results.

8. Power Balance Tests

Return to the PROGRAM MENU by pressing the MENU key, and select power balance tests. The POWER BALANCE test page (Figure 37) will be displayed.

a. Prepare for POWER BALANCE tests.

1. Use a jumper wire to keep the electric cooling fan on during the test
2. Disable RPM and carburetor mixture feedback controls per manufacturer's recommendation.
3. Disconnect and plug the EGR vacuum hose.
4. Stabilize the engine at the desired test speed, not less than 1000 RPM.

NOTE: If the TRIGGER PICKUP NOT SENSED or COIL CONNECTION NOT PRESENT messages appear and "flash" (when engine is running), check the BLUE primary lead and RED trigger pickup for proper connections.

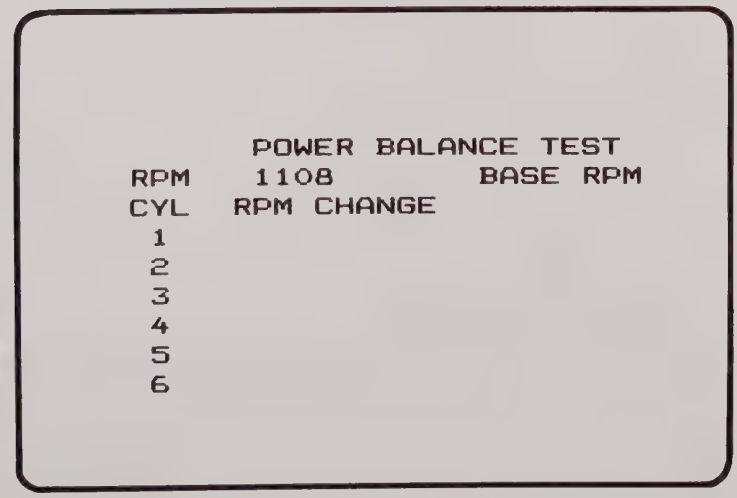


Figure 37. Help messages that detail how to prepare the vehicle for power balance tests are available for this page.

b. Either an automatic or a manual power balance test can be performed from the POWER BALANCE TEST page.

1. To perform an automatic power balance test, press the CONT key. The analyzer will automatically short out one cylinder at a time. The difference between RPM before shorting (BASE RPM) and RPM when shorted is displayed as RPM CHANGE. A new BASE RPM is computed for each cylinder as it is shorted. The test is complete when data for all cylinders is displayed (Figure 38).

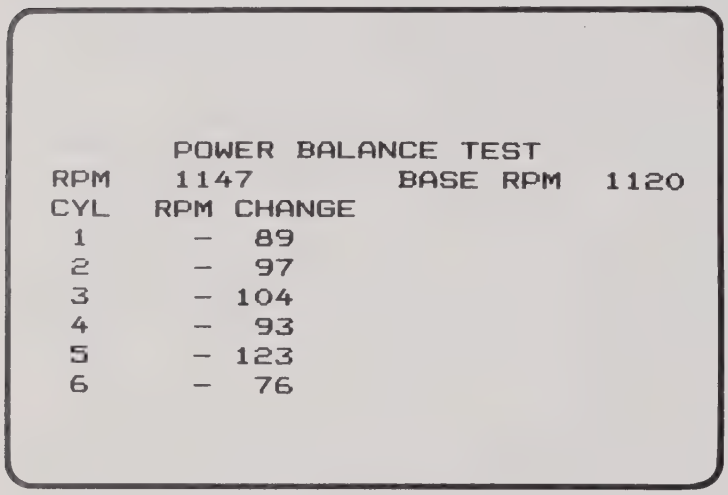


Figure 38. After automatic power balance tests are completed, help is available for performing manual power balance tests.

Power balance test results will remain displayed until they are cleared. It is not necessary to freeze results. If desired, test results may be printed out at any time during manual or automatic power balance tests.

2. To perform manual power balance tests, select the cylinder or cylinders to be shorted by pressing the remote control numeric keys corresponding to the cylinder number(s).

   NOTE: If the automatic power balance tests preceded the manual power balance tests, and the previous data was not cleared, the RPM CHANGE reading from the previous test will be retained until cylinders are shorted manually and new readings are displayed.

3. If a new cylinder is shorted within two seconds of the last cylinder being unshorted, the same BASE RPM will be used to calculate the new RPM CHANGE. If more than two seconds elapse after the last cylinder was unshorted, a new BASE RPM will be used to calculate RPM CHANGE.

   NOTE: When using the second method described above, allow the engine speed to stabilize after the cylinder is shorted out. Do not allow any cylinder to be shorted out for more than 10 seconds, or damage to the catalytic converter may result. To unshort a cylinder, press its corresponding key number a second time. To unshort all cylinders, press the CONT key.

4. If the engine being tested is a carbureted V-6, V-8 or horizontally-opposed engine with a multi-plane intake manifold, perform a fuel balance test.

a. Press the key numbers corresponding to the ODD-numbered cylinders. This will short out the cylinders fed by one carburetor barrel.

b. Allow the engine speed to decrease and stabilize and then press the CONT key to unshort all cylinders. Operate the engine for a few minutes to allow it to return to normal operation. The total engine speed change will be displayed next to each cylinder which was selected.

NOTE: Do not operate the engine for more than 10 seconds with cylinders shorted.

c. Press the key numbers corresponding to the EVEN-numbered cylinders. This will short out the cylinders fed by the other carburetor barrel. Allow the engine speed to decrease and stabilize, then press CONT.

d. Compare the RPM lost when all ODD cylinders were shorted to that lost when all EVEN cylinders were shorted. The difference should not exceed approximately 45 RPM.

Test Mode	Test	Read	Test Indications — Good
Power Balance	RPM Change	VDU	Each cylinder drops approximately the same amount *
	Vacuum Change	VDU	Drop or lower than normal
	HC Change	VDU	Approximately equal from cylinder to cylinder **
	O2 Change	VDU	Increase or higher than normal (base)

* Amount of drop and allowable variation depends upon type of engine, number of cylinders, shorting time and speed at which test was performed.

** HC change per cylinder should be used only if RPM change indicates a problem. Amount of increase and allowable variation depends on type of engine and emission controls, number of cylinders, speed at which test is performed and cylinder shorting time. On catalytic converter-equipped vehicles, HC change per cylinder may not be an accurate indication of engine performance.

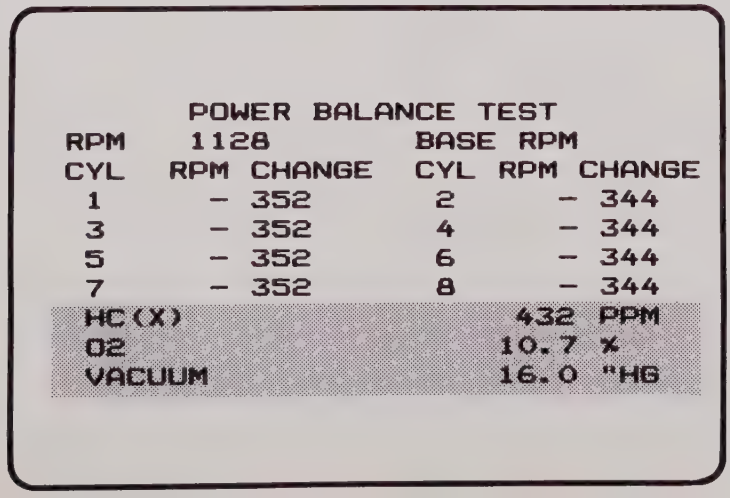

POWER BALANCE TEST
RPM 1128 BASE RPM
CYL RPM CHANGE CYL RPM CHANGE
1 - 352 2 - 344
3 - 352 4 - 344
5 - 352 6 - 344
7 - 352 8 - 344
HC(X) 432 PPM
O2 10.7 %
VACUUM 16.0 "HG

Figure 39. HC, O_2 and vacuum readings appear only with manual power balance tests. HC readings which are over range are marked (X).

PINPOINT TESTS AND VEHICLE ADJUSTMENTS

When the VEHICLE TEST page is selected, the analyzer may be used to perform pinpoint tests using its electrical and emission testing capabilities. Measurements on the fourth data line of the test page are used exclusively for this purpose. The DC VOLTS measurement may be changed to RESISTANCE and back again by pressing the VOLT/OHM key successively. Volts or ohms may be measured at any point in a vehicle circuit or component with the volt/ohm leads connected.

NOTE: Do not connect the volt/ohm leads to a "live" source.

The VEHICLE TEST page may also be used as a guide for performing various vehicle adjustments, such as dwell, timing, curb idle, and fuel mixture. The continuously updated digital readings on the page will indicate when an adjustment is within specification.

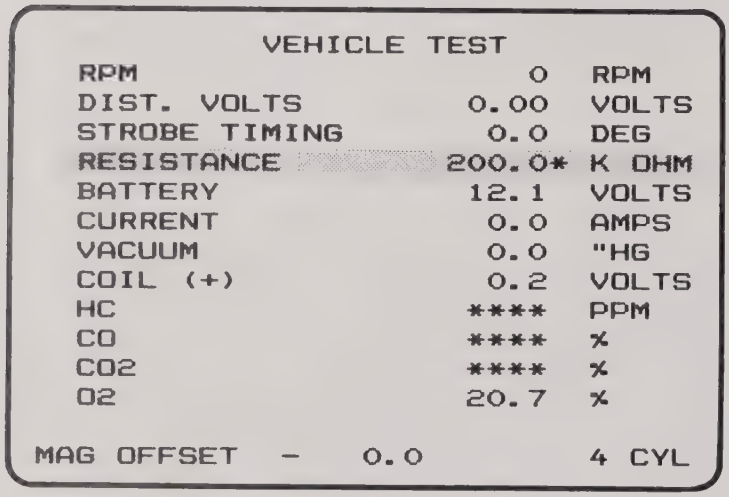


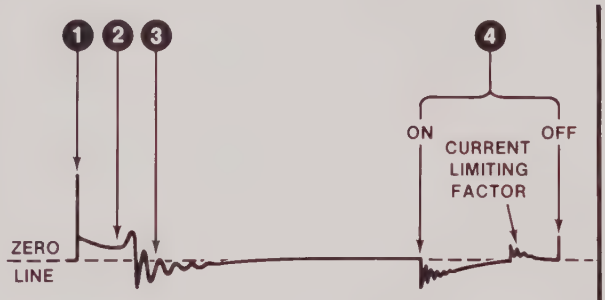
Figure 40. The fourth line of the Vehicle Test page is used exclusively for pinpoint tests. Over range resistance readings are marked (*).

IGNITION AND CHARGING SYSTEM SCOPE TESTING

To obtain maximum value from scope testing requires experience, the use of accumulated test data and careful observation of the scope, watching for abnormal patterns. To enable the operator to recognize abnormal patterns, Figure 41 illustrates normal patterns for various igition systems as points of comparison.

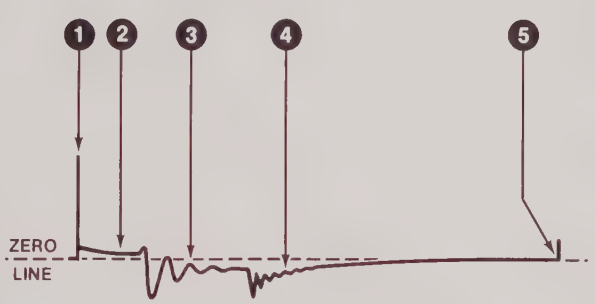
The presence of abnormal patterns may indicate the need to perform one or more of the tests from the charts in this section. Be sure to use the correct chart (electronic or breaker point) when performing tests.

NOTE: Sun has produced a manual entitled "Understanding Automotive Oscilloscope Patterns", which is a complete description of how to perform scope tests and how to interpret the results. Consult your Sun sales representative for details.



TYPICAL ELECTRONIC IGNITION SYSTEM PATTERN

1. **Firing line** from 7 to 18 kV with no more than 3 kV variation. Tests plug and rotor gap, broken wires and fuel mixture.
2. **Spark line** — with PATTERN SELECTOR in 5 ms position, spark duration should not be less than 0.8 ms nor more than 2.0 ms, approximately 1.5 ms preferred. The line should be level, between 2 and 4 kV. Tests plugs, wires, cap, rotor or engine condition affecting plug firing.
3. **Intermediate oscillations** should diminish gradually if coil is not shorted.
4. **Transistor opening and closing** indicates points at which transistor turns on and off. Tests control module and pickup coil in distributor cap.
5. **Current limiting** (on systems having saturation current limiting) tests for module condition and for high primary circuit resistance.



TYPICAL BREAKER POINT IGNITION SYSTEM PATTERN

1. **Firing line** from 5 to 15 kV with no more than 3 kV variation. Tests plug and rotor gap, broken wires and fuel mixture.
2. **Spark line** straight and level starting at 2 kV or less. Tests plugs, wires, cap, rotor, or engine condition affecting plug firing.
3. **Intermediate oscillations** test for coil, condenser or primary circuit defects. Should diminish gradually.
4. **Point closing**, short downward line followed by small oscillations. Tests for point condition and point spring tension.
5. **Point opening**, abrupt 90° angle to begin next firing line. Tests for pitted points or arcing caused by poor condenser action.

Figure 41. Typical Ignition System Patterns.

TEST	PURPOSE	TEST CONDITIONS	NORMAL TEST RESULTS	ABNORMAL TEST RESULTS — POSSIBLE CAUSES AND REMEDIES
Spark Duration test **NOTE: This test can be performed either during cranking or running. The cranking test is usually done on an engine which will not start.**	To determine if the spark duration is acceptable.	1. Set pattern to 5 ms. 2. Set circuit to SEC. 3. Set scale to 0-25 kV. 4. Crank engine and **quickly** read spark duration.	Spark duration should be between 0.8 and 2.0 ms. About 1.5 ms is preferred.	Duration **too short**: 1. High resistance primary 2. Low coil output Duration **too long**: 1. Fouled spark plug 2. Low compression 3. Spark plug gap too small
Spark plug firing voltage	To determine if plug firing voltage is within normal limits.	1. Start the engine and operate at 1000 to 1500 rpm. 2. Set circuit to SEC. 3. Set scale to 0-25 kV. 4. Set pattern to DISPLAY. 5. Note firing line amplitude and position.	Observe firing lines for all cylinders. Firing lines should be between 7 and 18 kV with no more than a 3 kV variation between cylinders.	If firing voltages are **uneven (some high):** 1. Worn spark plugs 2. Breaks in spark plug wires 3. Worn distributor cap 4. Vacuum leaks If firing voltages are **even, but too high:** 1. Open high tension coil wire 2. Worn spark plugs 3. Rotor gap too wide 4. Retarded ignition timing 5. Fuel mixture too lean 6. Faulty distributor cap If firing voltages are **uneven (some low):** 1. Low compression 2. Fouled spark plug 3. Incorrect plug gap 4. Shorted spark plug lead 5. Spark plug insulator cracked

OSCILLOSCOPE TESTING — IGNITION TESTING — ELECTRONIC SYSTEMS (Cont.)

TEST	PURPOSE	TEST CONDITIONS	NORMAL TEST RESULTS	ABNORMAL TEST RESULTS POSSIBLE CAUSES AND REMEDIES
Secondary insulation	Locate secondary circuit insulation breakdowns.	1. Operate engine at 1000 to 1500 rpm. 2. Set circuit to SEC. 3. Set pattern to DISPLAY. 4. Set scale to LOW, 0-25 kV. 5. Connect one end of a jumper lead to ground and the other end to the large portion of the resistance test contactor (Sun P/N 4344-0000). 6. Run the test contactor all over the following components, while observing firing lines on scope. a. Coil tower b. Coil high tension wire and boots c. Distributor cap and terminals d. Spark plug wires and boots	If an insulation breakdown occurs, firing lines will decrease in height.	Replace items having faulty insulation

OSCILLOSCOPE TESTING — IGNITION TESTING — ELECTRONIC SYSTEMS (Cont.)

TEST	PURPOSE	TEST CONDITIONS	NORMAL TEST RESULTS	ABNORMAL TEST RESULTS — POSSIBLE CAUSES AND REMEDIES
Secondary ignition circuit resistance	Determine acceptability of secondary circuit resistance by inspection of spark line slope.	Same as for Secondary Insulation test above.	A good spark line should be between 2 and 4 kV and should be relatively level.	1. Burned rotor tip 2. High resistance plug lead 3. Distributor cap segments burned 4. Faulty spark plug 5. Corroded distributor cap towers
Coil condition **NOTE: This test is not valid for Chrysler EIS systems.**	Determine if coil is in good condition by inspection of oscillations in intermediate section of secondary pattern.	1. Operate the engine at 1000 to 1500 rpm. 2. Set pattern to RASTER. 3. Set circuit to PRI. or SEC. 4. Observe intermediate section of waveform.	Oscillations in the intermediate section should gradually diminish.	1. Shorted coil
Cylinder timing accuracy	Determine if all cylinders are firing in the same relationship to TDC.	1. Operate the engine at 1000 to 1500 rpm. 2. Set pattern to SUPERIMPOSE. 3. Set circuit to SEC. or PRI. 4. Observe the transistor turn-off area of the waveform.	**4 cyl. engine** — Not to exceed 2% (2 degrees) **6 cyl. engine** — Not to exceed 4% (2 degrees) **8 cyl. engine** — Not to exceed 6% (2 degrees) **NOTE: The above is an approximation since it is impossible to see scope variations of less than one degree with complete accuracy.**	1. Bent distributor shaft 2. Worn distributor bushings 3. Worn distributor drive gear 4. Worn camshaft gear 5. Worn timing chain

OSCILLOSCOPE TESTING — BREAKER POINT SYSTEM

TEST	PURPOSE	TEST CONDITIONS	NORMAL TEST RESULTS	ABNORMAL TEST RESULTS—POSSIBLE CAUSES AND REMEDIES
Maximum coil output voltage (running)	Verify overall condition of ignition system by raising voltage to maximum.	1. Operate engine at 1000 to 1500 rpm. 2. Set circuit to SEC. 3. Set scale to 50 kV. 4. Set pattern to DISPLAY. 5. Use insulated pliers to disconnect one spark plug wire. Hold it away from engine ground. 6. Record maximum rise of firing line on 50 kV scale. 7. Reconnect spark plug lead. **NOTE: Observe manufacturer's recommendations for removing spark plug wires with engine running.**	The coil should produce a minimum voltage of 20 kV.	1. Faulty coil 2. Dwell out of limits 3. Excessive primary circuit resistance 4. Faulty secondary insulation 5. Low primary voltage
Secondary circuit insulation	Locate secondary ignition system insulation breakdowns.	1. Perform steps 1 thru 6 above. 2. Record maximum down-spike of waveform on 50 kV scale. 3. Reconnect spark plug lead.	The downard extension of the firing line should be ½ of the upward extension of the firing line. Absence of a spike or intermittant spikes indicate insulation breakdowns.	If fault occurs in **some** cylinders: 1. Faulty distributor cap 2. Faulty spark plug wires If fault occurs in **all** cylinders: 1. Cracked or carbon tracked coil tower 2. Faulty rotor 3. Faulty coil wires 4. Faulty distributor cap
Secondary circuit resistance	Determine if secondary resistance is abnormally high.	1. Operate the engine at 1000 to 1500 rpm. 2. Set circuit to SEC. 3. Set scale to 25 kV. 4. Set pattern to RASTER. 5. Note the appearance of each waveform spark line.	The spark line should be level and measure 2 to 4 kV. A sloping spark line which begins at a voltage greater than 4 kV and has a shorter than normal duration is abnormal.	1. Rotor tip burned 2. High resistance spark plug wire 3. Distributor cap terminals burned 4. Faulty spark plug

OSCILLOSCOPE TESTING — BREAKER POINT SYSTEM

TEST	PURPOSE	TEST CONDITIONS	NORMAL TEST RESULTS	ABNORMAL TEST RESULTS — POSSIBLE CAUSES AND REMEDIES
Coil and condenser	Determine condition of coil and condenser.	1. Operate the engine at 1000 to 1500 rpm. 2. Set circuit to PRI. or SEC. 3. Set pattern to 500V or 50kV. 4. Set pattern to SUPER-IMPOSE. 5. Observe point open and point close portion of dwell section.	The intermediate section of primary and secondary patterns should be a series of gradually diminishing oscillations.	1. Shorted coil 2. Leaky condenser 3. High resistance lead or poor connection to condenser
Breaker points	Determine condition of breaker points, condenser and distributor cam.	1. Operate the engine at 1000 to 1500 rpm. 2. Set circuit to either SEC. or PRI. 3. Set scale to 25 kV or 25V. 4. Set pattern to SUPER-IMPOSE. 5. Observe intermediate section waveform for gradually dimishing oscillations.	The point close section of the primary waveform should be a short straight downward line. In the secondary, the line should be followed by a few small oscillations. Spikes above the point close kV line or sloping/oscillating point closing lines are abnormal .	1. Breaker point spring tension too weak 2. Excessive distributor vibration 3. Worn or corroded distributor cam 4. Pitted, misaligned, burned or high resistance points 5. Defective condenser

OSCILLOSCOPE TESTING — BREAKER POINT SYSTEM

TEST	PURPOSE	TEST CONDITIONS	NORMAL TEST RESULTS	ABNORMAL TEST RESULTS — POSSIBLE CAUSES AND REMEDIES
Ignition system condition under load (snap acceleration)	Determine individual spark plug performance under load.	1. Operate the engine at idle speed. 2. Set circuit to SEC. 3. Set scale to 50 kV. 4. Set pattern to DISPLAY. 5. Snap accelerate engine to approx. 2000 rpm. Then release the throttle. 6. Note and record the minimum and maximum rise of the firing lines on the 50 kV scale.	All plug firing lines should increase moderately and uniformly. No individual spark line should be extremely high or low in relation to the average.	If firing voltage **too high**: 1. Spark plug gap too wide 2. Worn spark plug electrodes 3. Open spark plug wire 4. Improper fuel mixture 5. Open spark plug resistor 6. Vacuum system leaks If firing voltage **too low**: 1. Shorted spark plug wire 2. Broken spark plug insulator 3. Fouled spark plug 4. Low compression
Cylinder pattern comparison test	To enlarge an individual cylinder waveform for comparison with others.	1. Operate the engine at the desired test speed. 2. Set the circuit to PRI. or SEC. 3. Set scale to 500V or 50 kV. 4. Set pattern to DISPLAY. 5. Select the cylinder to be compared and depress the corresponding keypad number.	This test is primarily to determine whether or not individual waveforms deviate from the norm.	If one or more waveforms is substantially different from the rest, select and perform the scope test in this series of tests which will pinpoint the problem.

OSCILLOSCOPE TESTING — BREAKER POINT SYSTEM (Cont.)

TEST	PURPOSE	TEST CONDITIONS	NORMAL TEST RESULTS	ABNORMAL TEST RESULTS— POSSIBLE CAUSES AND REMEDIES
		8. Compare the enlarged waveform to the others being displayed. 9. Press CANCEL to return to initial state. 10. Repeat above procedure to compare other cylinder waveforms. 11. Select two or more keypad numbers. These waveforms will be superimposed at the top of the scope.		
Cylinder timing accuracy	Determine if all cylinders are firing in the same relationship to TDC.	1. Operate the engine at 1000 to 1500 rpm. 2. Set circuit to PRI. or SEC. 3. Set scale to 25V or 25 kV. 4. Set pattern to SUPERIMPOSE. 5. Record any misalignment (in degrees) of waveform point open patterns.	**4 cyl. engine** — Timing variation should not exceed 2% (2 degrees). **6 cyl. engine** — Timing variation should not exceed 4% (2 degrees). **8 cyl. engine** — Timing variation should not exceed 6% (2 degrees).	1. Worn distributor cam lobes 2. Worn distributor shaft 3. Worn distributor bushings 4. Worn distributor drive gear 5. Worn camshaft gear 6. Worn timing chain

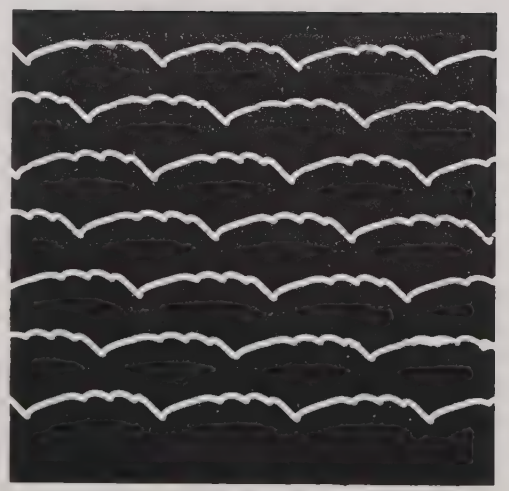
OSCILLOSCOPE TESTING — BREAKER POINT SYSTEM

TEST	PURPOSE	TEST CONDITIONS	NORMAL TEST RESULTS	ABNORMAL TEST RESULTS—POSSIBLE CAUSES AND REMEDIES
Coil output while cranking	Verify efficient functioning of primary circuit and coil (usually performed when vehicle won't start or is hard to start).	1. Disconnect the coil secondary lead from the center terminal of the distributor cap. Do not use the ENGINE KILL button. 2. Set circuit to SEC. 3. Set scale to 50 kV. 4. Set pattern to DISPLAY. 5. Crank engine with ignition key ON. 6. Record maximum rise of waveform on 50 kV scale. 7. Stop cranking and reconnect coil lead.	Should produce secondary circuit spikes of at least 20 kV.	1. Battery voltage low. 2. Excessive starter current draw 3. Faulty ignition switch 4. Failure of ballast resistor bypass circuit 5. Incorrect dwell 6. Excessive distributor resistance 7. Faulty coil or condenser 8. Faulty coil wire 9. Faulty primary connection
		NOTE: Observe manufacturer's recommendations concerning open circuit testing.		
Coil polarity	Determine if coil is delivering secondary voltage of correct polarity.	1. Start engine. Operate at 1000 to 1500 rpm. 2. Set circuit to SEC. 3. Set scale to 25 kV. 4. Set pattern to DISPLAY. 5. Note firing line amplitude and position.	Firing line should point up. If it points down, polarity is reversed.	1. Reverse primary connections at coil
Spark plug firing voltage	Determine if firing voltages are within normal limits.	Same as above	Firing lines for all cylinders should be uniform within 3 kV and should be between 5 and 15 kV. If some spikes are higher see causes. When dyno testing under load, firing voltages may increase 2 to 4 kV over no load. Record highest and lowest voltages.	1. Worn spark plugs 2. Faulty spark plug leads 3. Worn distributor cap 4. Vacuum leaks

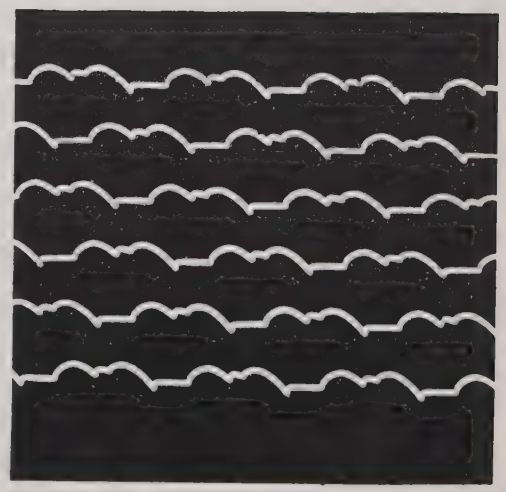
OSCILLOSCOPE TESTING — ALTERNATOR TEST — ALL SYSTEMS

TEST	PURPOSE	TEST CONDITIONS	NORMAL TEST RESULTS	ABNORMAL TEST RESULTS — POSSIBLE CAUSES AND REMEDIES
ALTERNATOR RIPPLE PATTERN	Detect defective alternator	1. Set pattern to RASTER. 2. Set circuit to SPEC. 3. Place the GREEN pickup clamp around the alternator output (+) lead or the positive battery cable. 4. Start engine and operate at approx. 1000 rpm. 5. Turn headlights on and on high beam. 6. Observe waveform and compare to test result column.	A normal alternator output pattern is a series of wave-shaped ripples of the same height and spacing. Under no load conditions, the waveform will have uniform spikes and peaks. Abnormal waveforms will be uneven and jagged.	Faulty alternators must be removed from the vehicle for repair.

Normal Alternator



Open Diode



Shorted Diode

ON-BOARD COMPUTER TESTING

General

The Sun Data Link, Model DL-100, shown in Figure 41a, interfaces with Ford, Chrysler and General Motors electronic engine control systems. An optional accessory, the Data Link is mounted beneath the MEA's VDU and contains a 3.5 inch floppy disk drive.

Through separate disk programs, the Data Link can sample the system's data stream, provide test routines and display trouble codes. Test capabilities depend on the make and model of the vehicle tested. The applicable disk program guides contain specific information about the operation of each disk.

The Data Link is connected to the vehicle diagnostic connector by a Ford, GM or Chrysler diagnostic harness and operated by the remote control keypad.

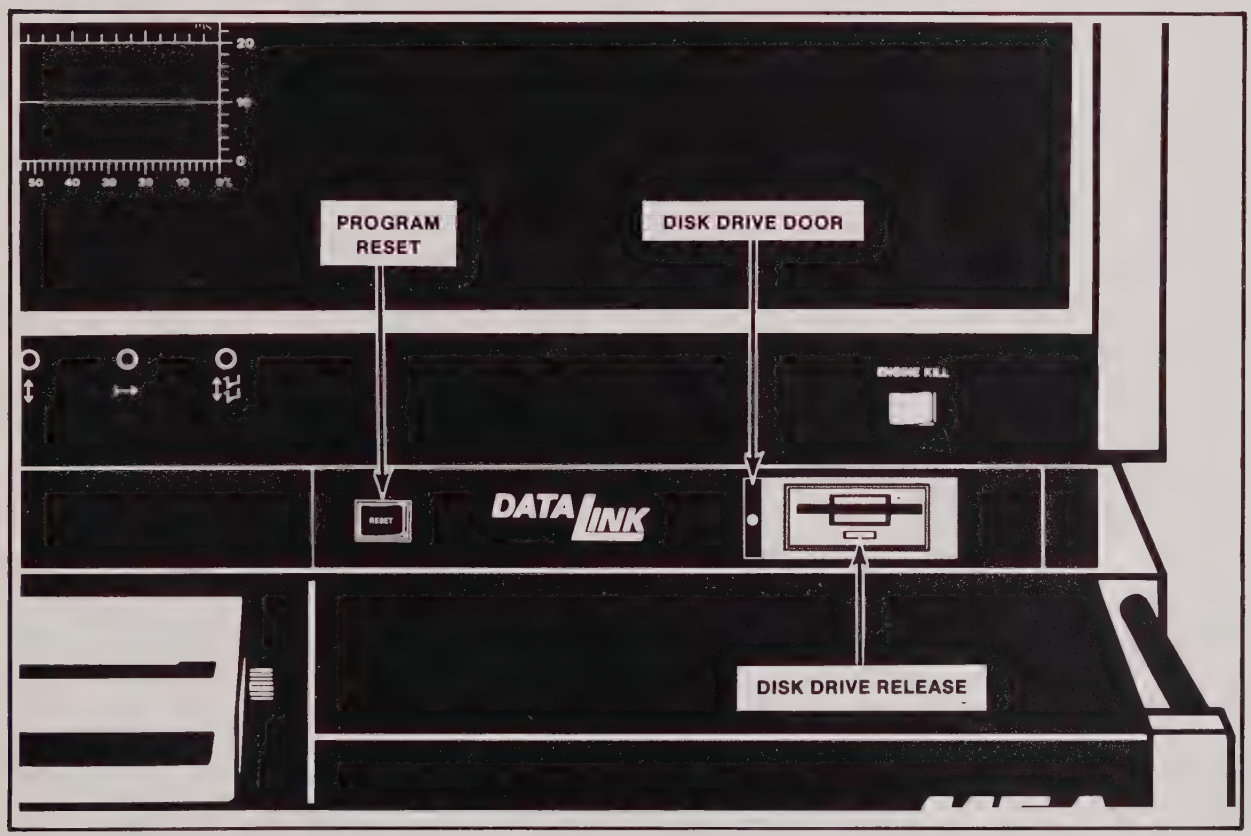


Figure 41a. Data Link

Controls

The analyzer remote control keypad contains three keys (YES, NO and BACKUP) used exclusively for Data Link control; and two keys (CURSOR/ENTER and ENGINE/SET-UP) which combine DATA LINK and engine test control functions. Refer to "Controls" for illustrations and descriptions of these keys.

Backup Function

The Data Link backup function permits the operator to return to a previous Data Link page to review information or to make different entries or selections. The operator can back up within a test sequence. Once the program moves forward into another sequence, in most cases, the program will not backup past this point.

Program Reset Function

The RESET switch (Figure 41a) on the front panel of the Data Link is used to re-start the disk. It may be pressed when changing disks, testing another vehicle, or during testing to start the program over.

Test Preparation And Procedure

Before testing an engine with the Data Link, refer to the manufacturer's recommended procedure for determining if the vehicle problem is caused by failures outside of the electronic engine control system.

Lead Connection

Connect the appropriate diagnostic harness from the connector labeled VEHICLE COMPUTER on the rear of the Data Link to the diagnostic connector on the vehicle to be tested. Ford and Chrysler each use a single standard diagnostic harness for all applications. GM uses either a 5-pin or a 12-pin connector, depending on the year.

1. FORD: Connect the Ford diagnostic harness (PN6004-0443) from the Data Link to the diagnostic connector (Figure 41b) located in the engine compartment.

2. CHRYSLER: Connect the Chrysler diagnostic harness (PN6004-0442) and Chrysler adapter cable (PN6004-0525) from the Data Link to the diagnostic connector (Figure 41c) located in the engine compartment.

3. GENERAL Motors: Connect the appropriate diagnostic harness as follows, depending on the year of the car. For 1981 GM vehicles, connect the 5-pin diagnostic harness (PN6004-0417) to the diagnostic connector (Figure 41d) located under the dash. For all other GM vehicles, connect the 12-pin diagnostic harness (PN6004-0522) to the diagnostic connector (Figure 41e) located under the dash.

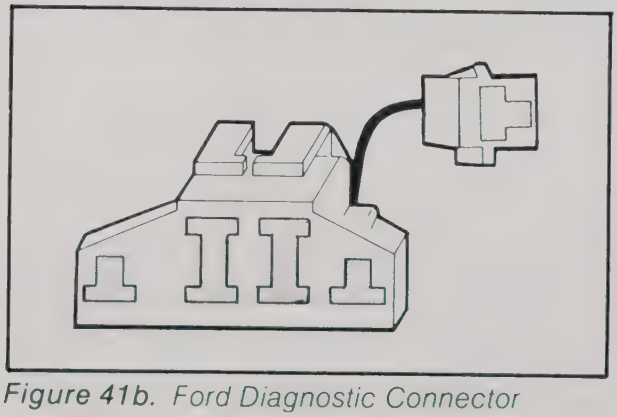


Figure 41b. Ford Diagnostic Connector

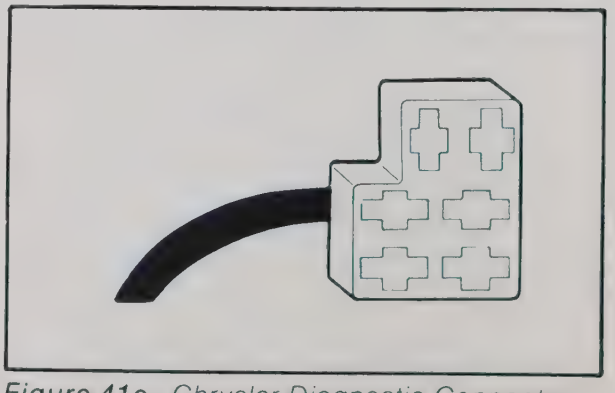


Figure 41c. Chrysler Diagnostic Connector

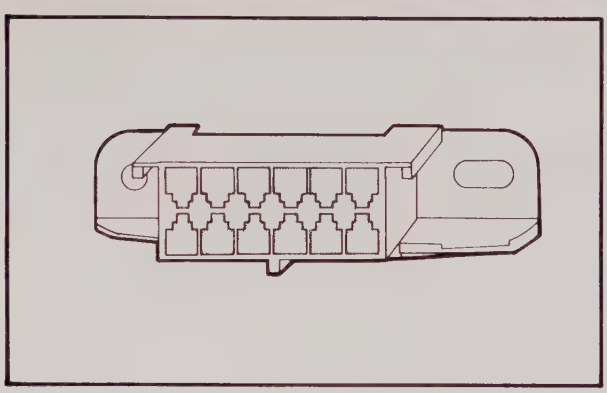


Figure 41d. GM 5-Pin Diagnostic Connector

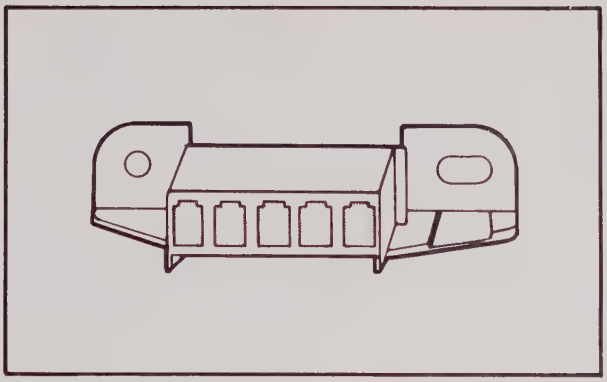


Figure 41e. GM 12-Pin Diagnostic Connector

Test Procedure

1. Proceed through the analyzer system check and calibration pages to the PROGRAM MENU page and select the Data Link function. The DATA LINK TITLE page will be displayed.

2. Slide the disk drive door and insert the metal shutter end of the correct disk for the vehicle make being tested into the slot (label side up). Push in until the disk drive (Figure 41a) latches.

3. Follow other instructions displayed on the VDU. For more specific information about the operation of each disk, refer to the Program Guide for the disk being used.

4. During disk operation, it is possible to leave the Data Link program at any point and select other analyzer functions.

   A. Press the ENGINE/SET-UP key to advance directly to the VEHICLE TEST page.

   B. Press the MENU key to return to the PROGRAM MENU page and select other functions (ie. power balance, vehicle set-up, etc.).

   C. Press the CONT key to return from analyzer pages to the Data Link page which was previously left.

5. Analyzer scope, print and freeze functions are operative during the Data Link program. Scope settings will appear in reverse video at the top of Data Link pages. It will not be possible to select individual cylinder scope displays while in the Data Link mode. Individual cylinder scope displays are available from the Vehicle Test page.

After Testing

1. Disconnect the Data Link diagnostic harness.

2. Press the disk release (Figure 41a) and remove the disk. Return it to the disk sleeve in the MEA-1500 three-ring binder.

3. Press the MENU key to return to the PROGRAM MENU page, or turn power OFF.

NOTE: It is recommended that the disk be removed from the Data Link before power is turned off.

Routine Maintenance

Test Lead Maintenance

The diagnostic harnesses will retain their new appearance if they are cleaned periodically with waterless, non-abrasive hand cleaner and wiped dry.

Care And Maintenance Of Disks

Disks should be kept clean and dry, and should be stored in the disk sleeve when not in use.

CAUTION: Magnetic materials, such as magnetized screw drivers, electric motors, coils, HEI distributors, etc., should be kept away from the disks, which can be ruined with a magnet.

Maintaining Tester Finish

The Data Link has a stain-resistant baked enamel finish, which should be polished with automobile wax and periodically wiped with a damp cloth.

PRINTER OPERATION AND MAINTENANCE

General Description

The optional printer is installed to provide service shops with actual proof of tests performed on vehicles serviced. Installation and set-up of the printer is provided by service personnel.

Perforated print paper, divided into 9 1/2" x 11" sections (P/N 0528-0994), is bottom-fed into the printer from a paper storage compartment. Replacement ribbon cartridges (P/N 0528-0995) install easily.

Printer Controls

NOTE: All controls on the front of the printer (Figure 42) should be disregarded since all printer functions are performed automatically through the remote control keypad upon installation and power-up.

Pressing the printer buttons may affect the printer operation.

The three indicator lights on the printer front panel (Figure 42) do provide the operator with useful data.

SEL light — The SEL light indicates communication with the engine analyzer. The light must be on for the printer to operate.

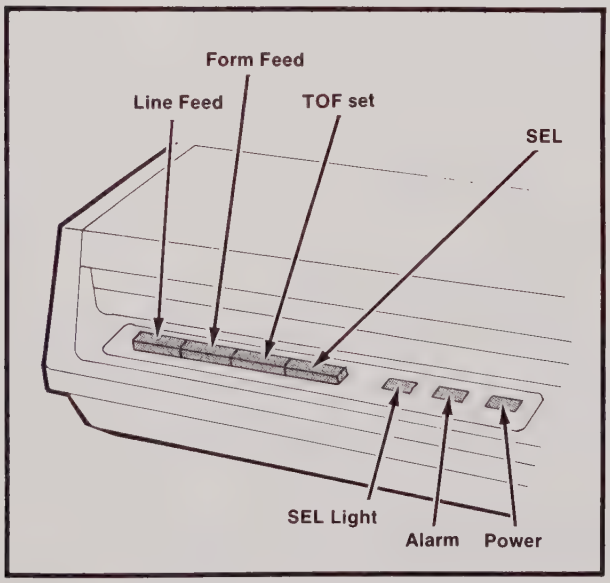


Figure 42. Front Panel Buttons and Indicators.

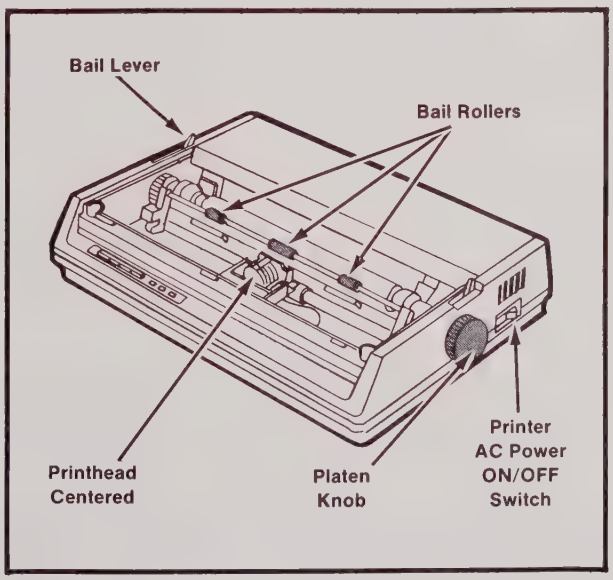


Figure 43. Location of Controls.

ALARM — The ALARM lights when paper is out. Printing stops until paper supply is replenished. The VDU will also give an indication of empty paper supply.

The ALARM also lights when the printhead becomes jammed or stopped during the printing process.

POWER — The POWER light indicates that the AC switch (Figure 43) is on and the printer is powered up.

The printer also has integral factory-set switches that must not be altered or re-set in any way. The rear cover of the printer should **not** be removed.

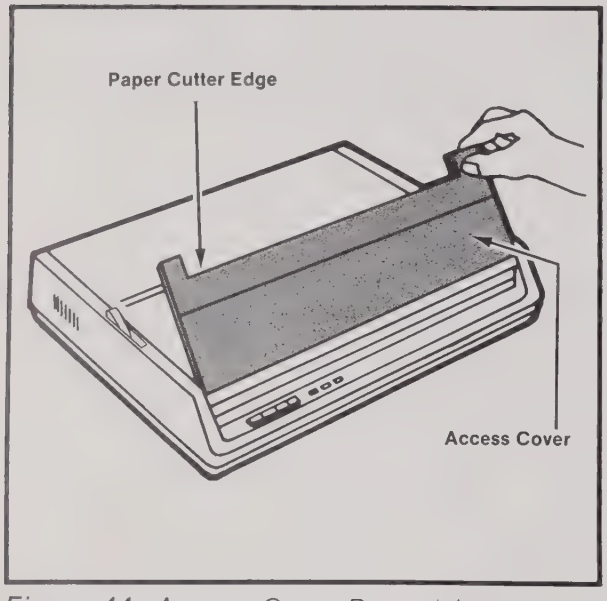


Figure 44. Access Cover Removal.

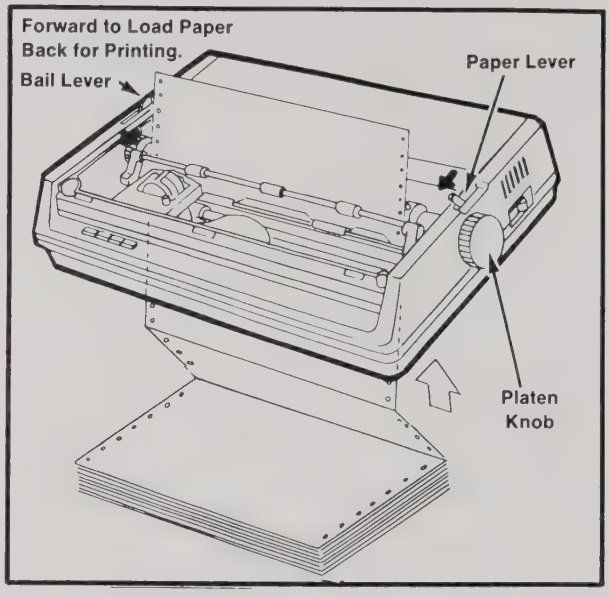


Figure 45. Bottom Paper Feed Loading.

Paper Loading

1. Turn the printer AC power switch (Figure 43) to PRINTER OFF. (POWER indicator light OFF.)

2. Remove the printer access cover (Figure 44) by lifting it off.

3. Place the stack of print paper in the compartment below the printer.

   NOTE: Only one-part paper perforated into 9 1/2" x 11" sections with pin feed holes (P/N 0528-0994) should be used.

4. Lift the bail. (Bail lever forward.) The paper lever should be open (forward). Refer to Figure 45.

5. Take the first sheet of paper and feed it through the bottom of the printer and into the paper guides, as per Figure 45.

6. Align and mount the holes of the paper with the corresponding pins (Figure 46).

   NOTE: Adjustable pin feeds should always be set to accommodate 9 1/2" width print paper (P/N 0528-0994). If for some reason pin feed width is not set at 9 1/2", re-set by pushing the pin feed adjustment levers (located just to the outside of each set of pins) forward and sliding the mechanism(s) to the correct (9 1/2") width. Push adjustment levers back into place to lock mechanism in new position. Refer to Figure 46.

7. Lower the bail and replace the access cover.

8. Turn printer power switch back ON. (POWER indicator light and SEL light ON.)

9. Press PRINT on the remote keypad twice quickly. Paper will automatically advance.

10. After the paper stops advancing, advance the paper manually with the platen knob until a perforation is lined up with the tear-off edge of the printer access cover.

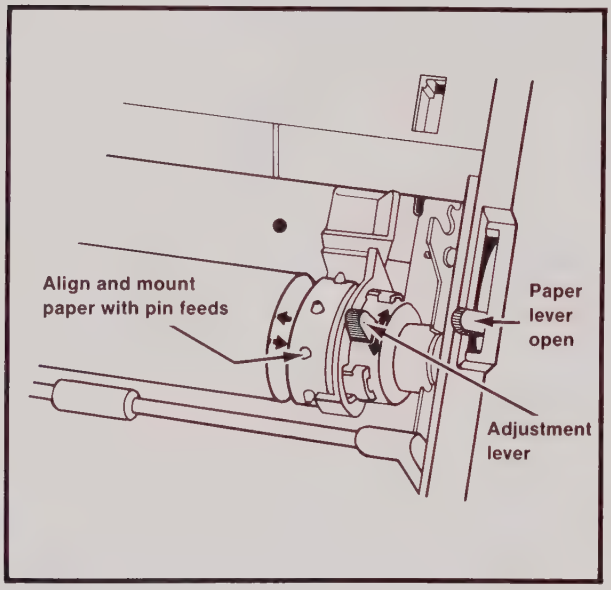


Figure 46. Adjustable Pin Feed.

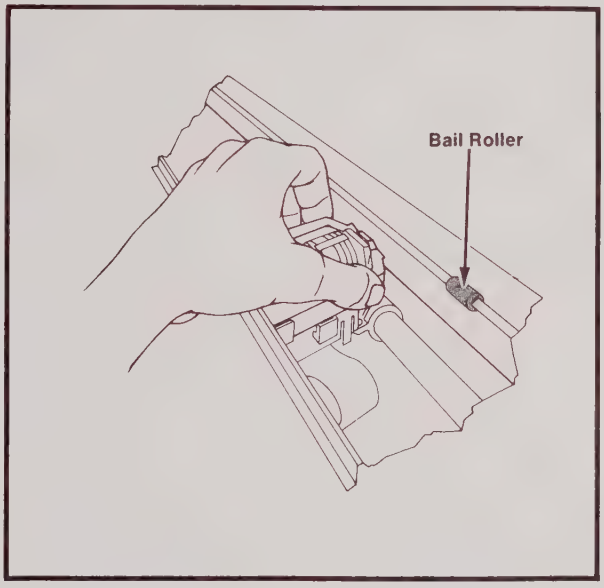


Figure 47. Grasp Cartridge Lift Up.

Printer Maintenance

Ribbon cartridge replacement

1. Turn the printer AC power switch OFF. (POWER indicator light OFF.)

2. Remove the printer access cover.

3. Gently slide the printhead to the middle of the printer (Figure 43).

4. To remove the old ribbon cartridge, grasp it on either side of the printhead and lift up (Figure 47).

5. Install the new black ribbon cartridge (P/N 0528-0995) by inserting the cartridge on to the printhead plate.

   To insert the cartridge on printhead plate, tilt the side of the cartridge opposite the ribbon shield so that portion of the cartridge slides on to the front of the printhead plate. Lower the top of the cartridge containing the side with the ribbon shield over the printhead. See Figure 48. (Do **not** remove the ribbon shield.) A tab on each side of the cartridge will align perfectly with inserts on the printhead plate (Figure 49).

6. Press gently on the cartridge until it snaps into place (Figure 50).

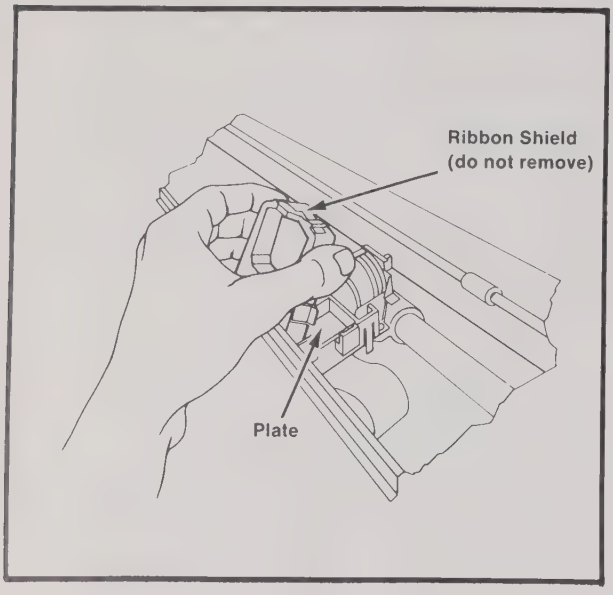


Figure 48. Installing Ribbon Cartridge.

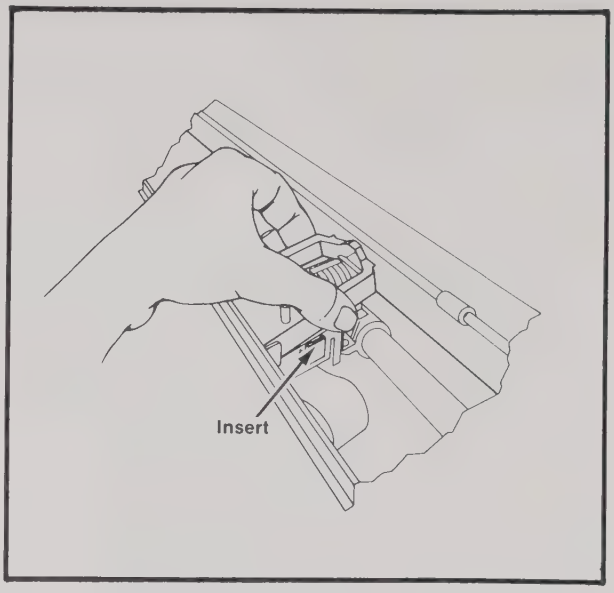


Figure 49. Installing Ribbon Cartridge.

7. Be sure the blue printhead gap lever, located to the left of the ribbon cartridge (Figure 51), is set in the number one (1) position.

Basic troubleshooting

Basic settings and controls should be checked before calling for Sun service:

1. The AC switch on the printer must be turned on, as indicated by the lit POWER light on the front panel.

2. Printer must be in SEL mode, indicated by the SEL light on the front panel.

3. Bail lever should be positioned toward the back of the printer during operation. (Rollers should be in contact with paper.) Paper lever should be positioned toward the front.

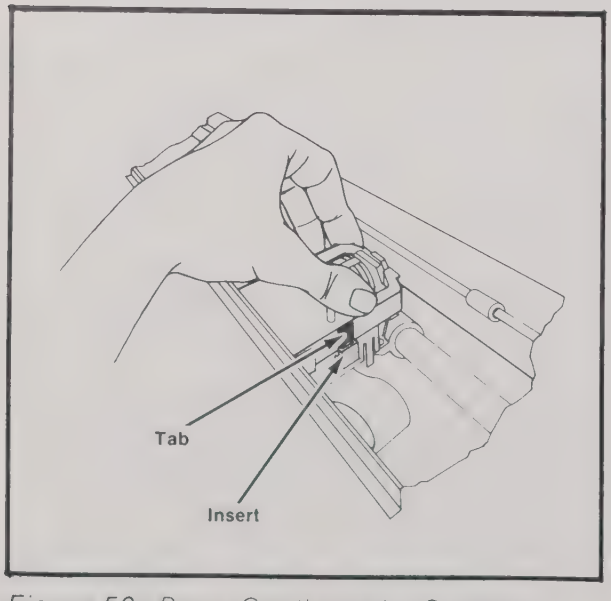


Figure 50. Press Gently on the Cartridge.

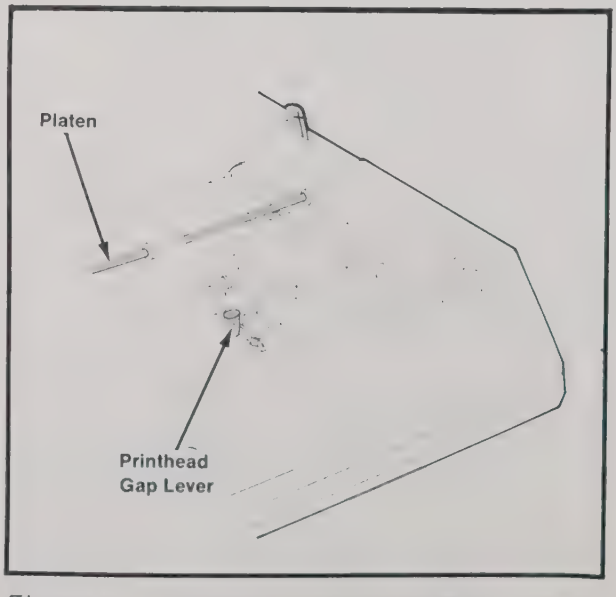


Figure 51. Location of Printhead Gap Lever.

4. Blue printhead gap lever should be in number one (1) position.

5. The ALARM should be OFF. If the ALARM indicator is ON, check to see if paper supply is full and is loaded properly and also check to see if printhead is jammed or stopped.

Routine maintenance

For trouble-free operation, the printer should be cleaned as follows at least once a month (or after 300 hours of operation):

NOTE: Do not apply any lubricants to the printer.

1. Turn off AC power. Remove paper from printer.

2. Remove the printer access cover.

3. Using a clean, dry, soft cloth, dust the area around the carriage shaft, platen, and paper sensor. Remove any loose paper particles or other debris.

4. With the nozzle attachment of a vacuum cleaner, vacuum the carriage shaft and paper feeding areas very carefully to remove any accumulated dust. Do not use a compressed air supply.

5. Re-load paper (see "Paper Loading") and replace the access cover.

Printer Operation

Before operating printer, verify that the paper has been loaded correctly and the proper indicators are lit as described in "Printer Controls". Also check that bail lever and paper lever are set as shown in Figure 45.

Setting Top of Form

1. At printer power-up, always **manually** set top-of-form (TOF). This is done by advancing the paper with the platen knob until a perforation is lined up with the tear-off edge of the printer cover.

   NOTE: Do not attempt to use the TOF SET and FORM FEED buttons on the printer. The MEA automatically controls the printer. Pressing these buttons may adversely affect the printer operation.

Printing

2. To print a VDU page, simply press the PRINT button on the remote keypad. After a momentary pause, information presented on the VDU will be printed and several blank lines will be added to separate the next printed page. The indicated prompts on the VDU will **not** appear on the printouts.

Removing a page

3. After a page has been printed, press the remote PRINT key twice quickly. The paper will automatically advance until the next perforation is aligned with the printer cover.

   NOTE: If the perforation does not align with the edge of the printer cover, manually turn the platen knob until the perforation is in line.

4. Tear the paper off against the edge of the printer cover.

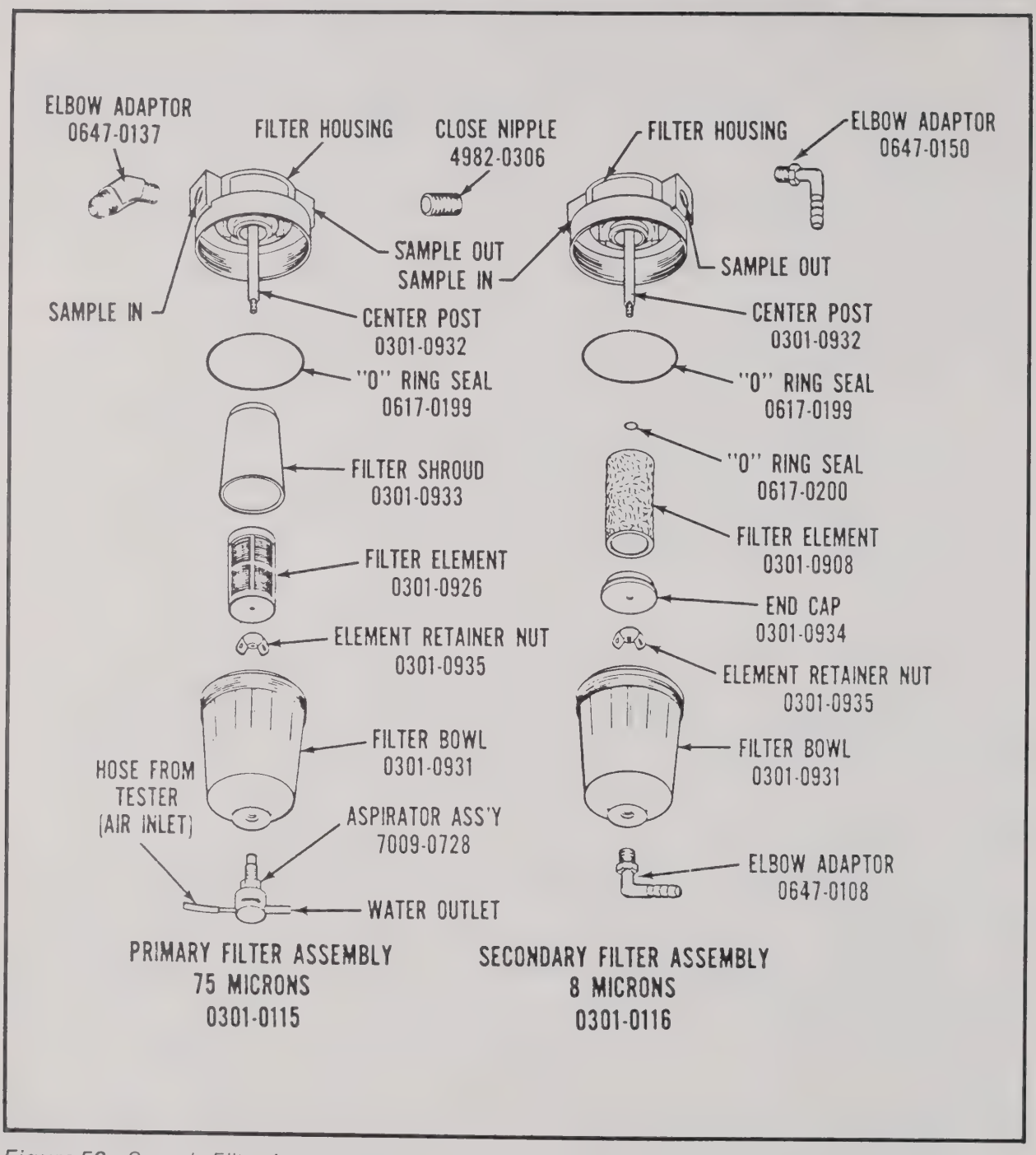


Figure 52. Sample Filter Arrangement.

MAINTENANCE and SERVICE

General

The maintenance and service procedures for the engine analyzer presented in this section are those in which the operator can perform. All other service should be performed by an authorized representative. If an emissions module option is not installed, the filter and sample probe maintenance procedures are not applicable.

Sample Hose Maintenance

Periodically inspect the SAMPLE HOSE for any signs of damage such as leaks, cuts, and kinks. Also, check sample hose connections for tightness. Replace hose if leaks are found or suspected.

Sample Probe Maintenance

Frequently inspect the SAMPLE PROBE for damage. Check for clogged holes in the probe tip. If the holes are found to be clogged, use a piece of stiff wire or other suitable object to dislodge and remove any foreign matter.

Filter Maintenance

When to service

The primary and secondary filters should be replaced or cleaned when the LOW FLOW message appears. Before replacing or cleaning the filters, however, it is recommended that the sample probe be serviced and/or cleaned. Then, if the response time is still slow, clean or replace the filters.

A label explaining filter maintenance and installation appears on the back of all testers.

Primary Filter Service

The primary filter element may be cleaned or replaced. Service the primary filter as follows:

1. Disconnect the water outlet and air inlet hose from the fitting on the filter bowl. See Figure 52.

2. Unscrew the filter bowl from the filter housing by turning the bowl counterclockwise.

   CAUTION: When removing the filter bowl, be careful not to damage the "O" ring.

3. Turn the element retainer nut counterclockwise and remove the filter element.

4. Wash out the filter bowl and element in a mild soap and water solution. Allow the bowl and element to dry before reassembling.

5. Reassemble the primary filter in reverse order of disassembly.

   NOTE: Be sure the "O" ring is properly positioned in the groove of the filter bowl.

6. Reconnect the water outlet and air inlet hoses.

Secondary Filter Service

The secondary filter element must be replaced when it becomes dirty or clogged. Service the secondary filter as follows:

1. Disconnect hose from the elbow adapter. See Figure 52.
2. Unscrew the filter bowl from the filter housing by turning the bowl counterclockwise.

   CAUTION: When removing the filter bowl, be careful not to damage the "O" rings.
3. Turn the element retainer nut counterclockwise and remove the end cap.
4. Remove and discard the old filter element.
5. Wash out the filter bowl in a mild soap and water solution, then allow it to dry.
6. Install a new filter element.
7. Reassemble the secondary filter in reverse order of disassembly.

   NOTE: Be sure the "O" rings are properly positioned during assembly.

Maintaining Tester Finish

The Modular Engine Analyzer has a finish of stain resistant baked enamel and brushed aluminum. It is recommended that the painted and plated surfaces be polished with automobile wax. Once this has been done, a periodic wipedown with a dry cloth will be sufficient.

Lubrication

Every sixty to ninety days, apply a light machine oil to the cabinet casters so they will roll freely.

Test Lead Maintenance

The test leads and power cord will retain their new appearance if they are cleaned periodically with waterless hand cleaner and wiped dry.

Calibration

To select the CALIBRATION MENU (Figure 53), return to the original PROGRAM MENU and select the fourth option.

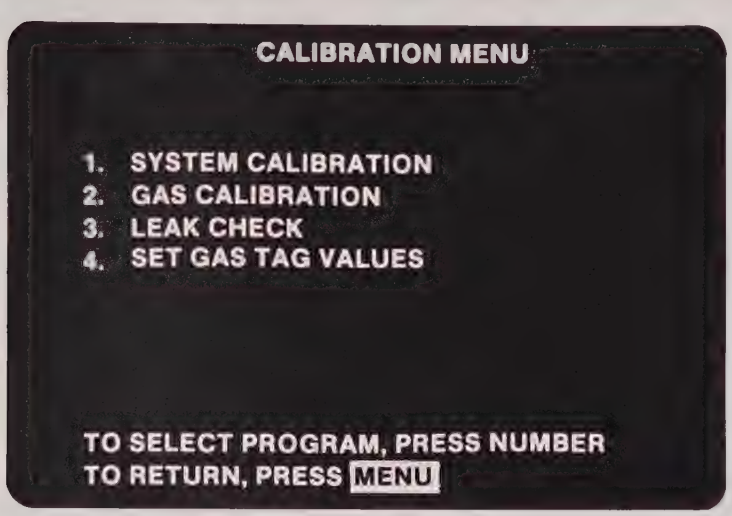


Figure 53. Calibration Menu (Emissions).

NOTE: The CALIBRATION MENU is available only when the emissions option is installed.

The four selections on the CALIBRATION MENU are explained in the following paragraphs. HELP messages are available to the operator throughout the calibration sequence.

To perform selections two through four, a bottle of certified calibration gas (supplied locally) and Kit. No. 120-446-1 (with a pressure regulator and calibration hose) must be attached to the brass fitting of the gas calibrate port on the back of the unit. The toggle switch above the filters should also be set to the OPERATE position. The hexane/propane ratio and the gas values on the certification tag of the gas bottle must be set with values required by the state before gas calibration and leak check can be performed.

Selection #1: System Calibration

This page (Figure 54) is identical to the general test calibration page which appears automatically after the self-test/warm-up page upon system power-up. It allows the analyzer to be re-calibrated without having to turn the unit off and perform self-test/warm-up procedures over again.

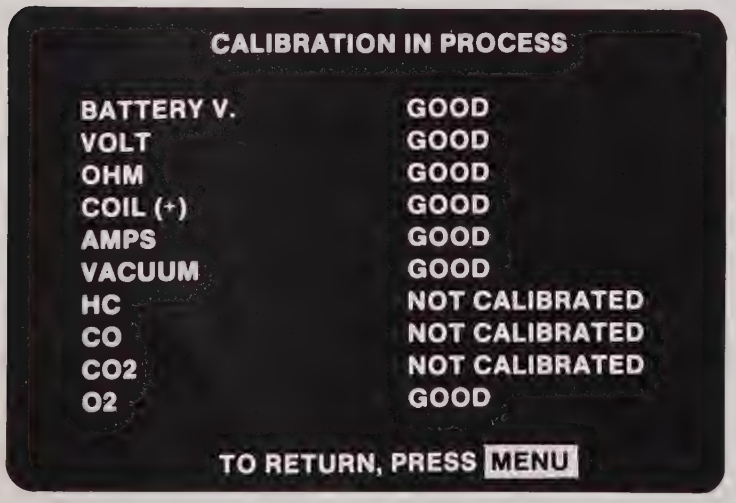


Figure 54. Calibration Page.

NOT CALIBRATED appears on emissions (HC, CO, CO_2, or O_2) if tester is not fully warmed up. If NOT CALIBRATED appears, return to main CALIBRATION MENU and perform calibration when WARM-UP COMPLETE appears on the menu page with the prompt to proceed.

If SERVICE REQUIRED appears on the VDU, remove all connections from engine and repeat calibration.

Additional information for "System Calibration" page is available through HELP messages.

Selection #2: Gas Calibration

This selection is used to verify the accuracy of the analyzer's HC, CO_2, O_2, and CO measurements. Follow the instructions on the VDU to gas-calibrate the analyzer. Consult HELP messages for additional data.

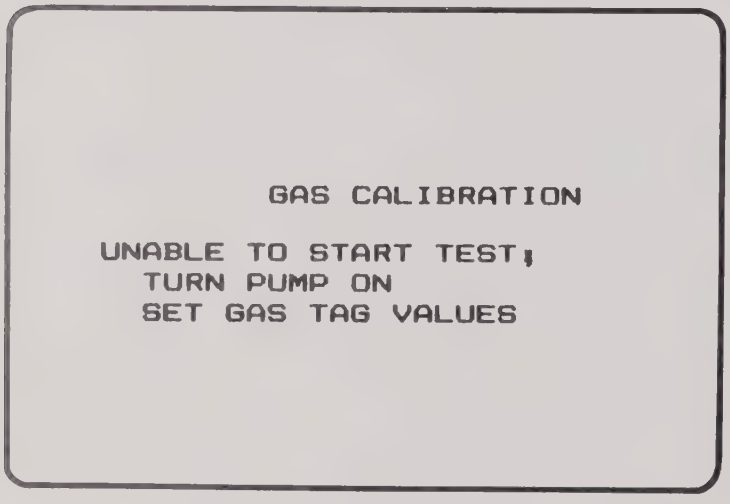


Figure 55. Gas Calibration Message.

NOTE: Before gas calibration can be performed, the hexane/ propane ratio and the gas values on the certification tag of the gas bottle must be set (Figure 55). Refer to Selection #4 of the main CALIBRATION MENU (described below) to set the values.

Gas calibration must be completed before a leak check can be performed.

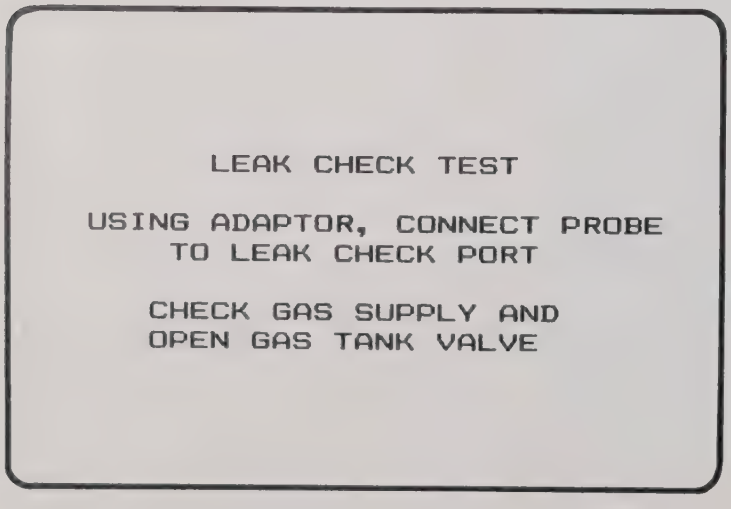


Figure 56. Leak Check Message.

Selection #3: Leak Check

The leak check is performed to verify that exhaust sampling system of the analyzer is air-tight and free of leaks after sampling system component replacement or cleaning. The messages for performing the leak check will be automatically displayed (Figure 56).

If the leak check is o.k., LEAK CHECK PASSED will be displayed. If any other message displays, check hose, probe, connections, filters—or whatever system is indicated on the screen—for leaks prior to repeating test. If the check fails a second time, call for Service.

Selection #4: Set Gas Tag Values

This page allows hexane/propane ratio and gas tag values to be set (Figure 57). These values must be entered **prior** to gas calibration procedure.

Enter values as per instructions on the screen.

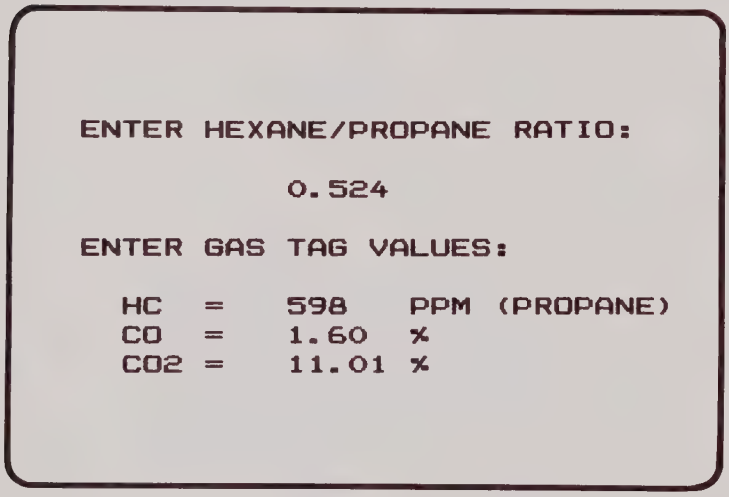


Figure 57. Hexane/Propane Ratios and Gas Tag Values Set.

1. Enter Hexane/Propane ratio.

   The hexane/propane ratio is located on a label on the rear of all testers. Using the numeric keys, enter this ratio. The data entry field to be filled in will be indicated in reverse video.

2. Enter gas tag values from calibration bottle certification tag. Data entry field to be filled in will be indicated in reverse video.

   NOTE: If hexane gas is used, HC value must be transferred to propane equivalent.

   To convert hexane tag value into propane equivalent, divide the hexane tag value by the hexane/propane ratio.

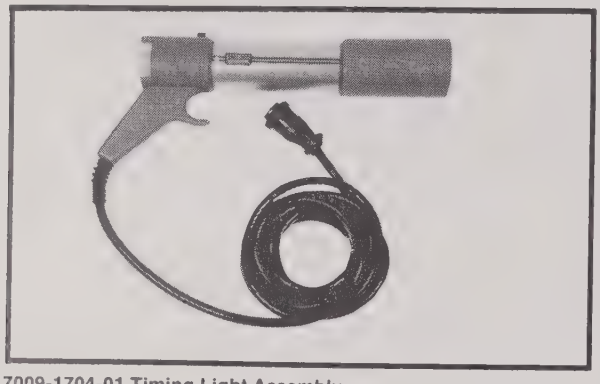
   For example, if the hexane tag value is 300 ppm and the hexane/propane ratio is .52, then 300 divided by .52 equals 576. Enter 576 for HC propane ppm reading.

   If the analyzer will not accept the gas tag values entered, entries will flash. Re-check numbers and re-enter.

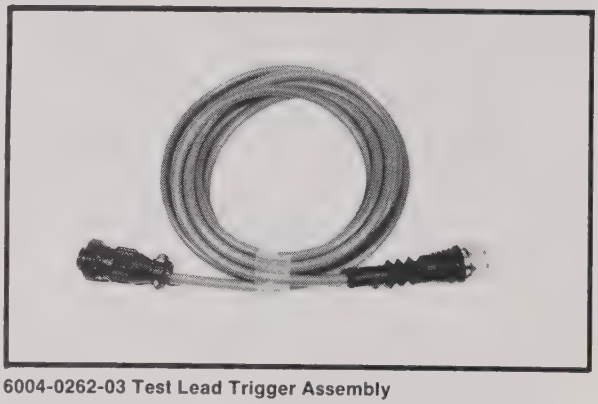
   Consult HELP messages for additional data.

STANDARD AND OPTIONAL ACCESSORIES

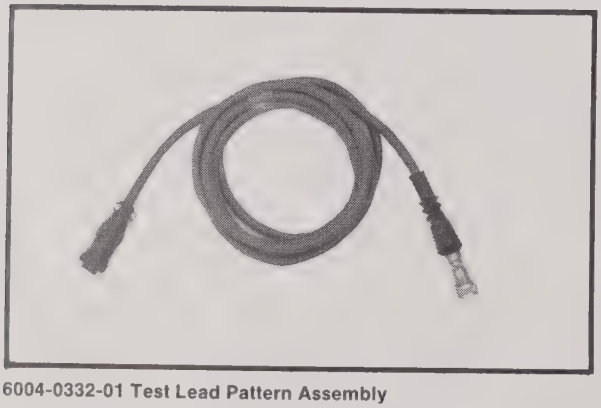
STANDARD



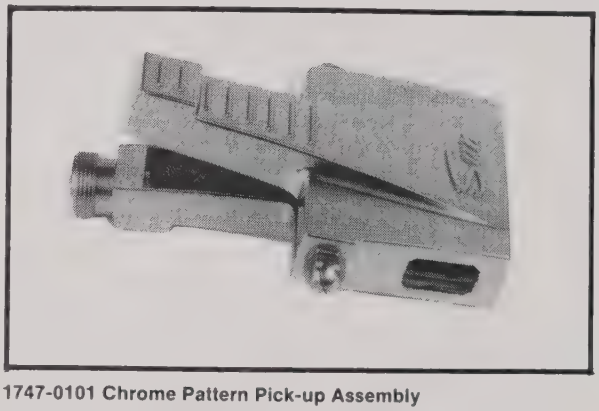
7009-1704-01 Timing Light Assembly



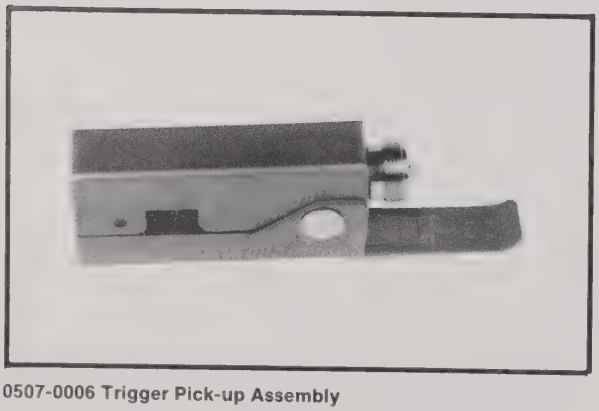
6004-0262-03 Test Lead Trigger Assembly



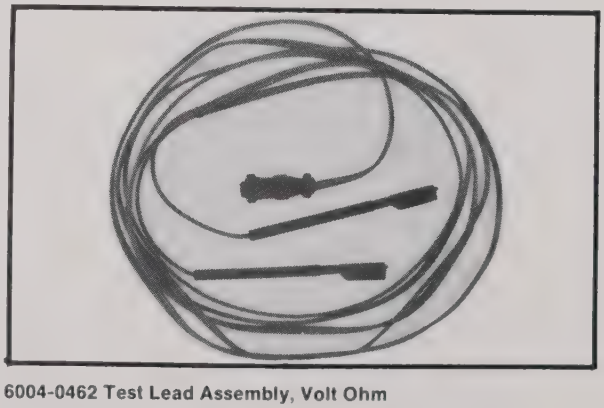
6004-0332-01 Test Lead Pattern Assembly



1747-0101 Chrome Pattern Pick-up Assembly

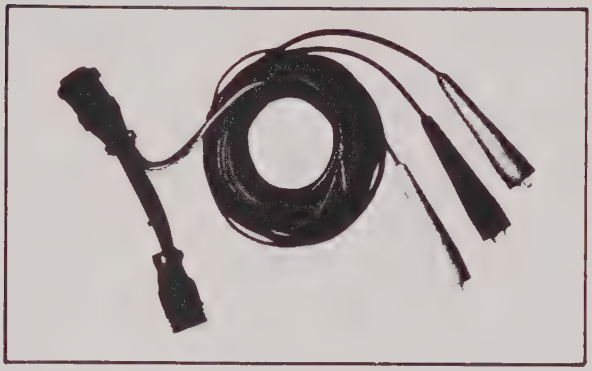


0507-0006 Trigger Pick-up Assembly

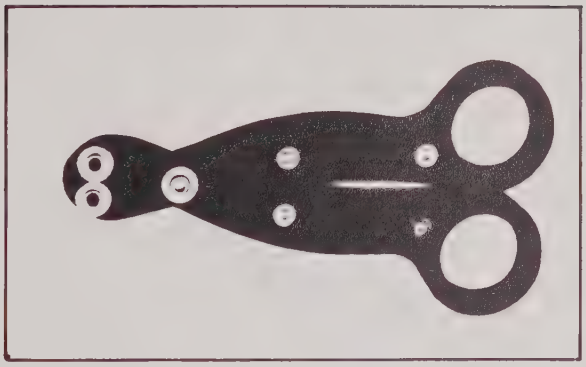


6004-0462 Test Lead Assembly, Volt Ohm

STANDARD (continued)

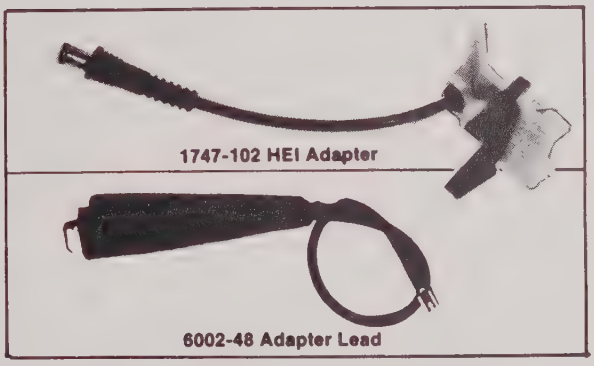


6005-0161-01 Universal Test Lead Assembly

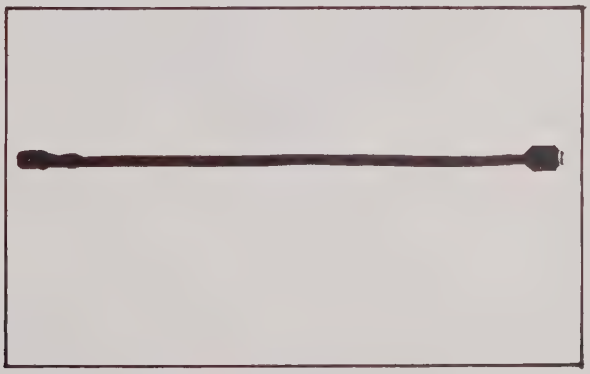


0002-1028 Insulating Pliers

3676-0501 Ignition Coil Terminal Adapters

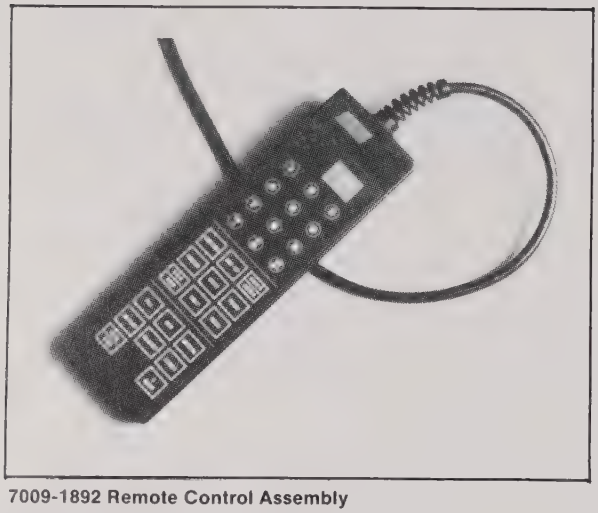


0120-0240 HEI Adapter Kit



6005-0067 Test Lead Assemblies (2) (1 shown)

STANDARD (continued)

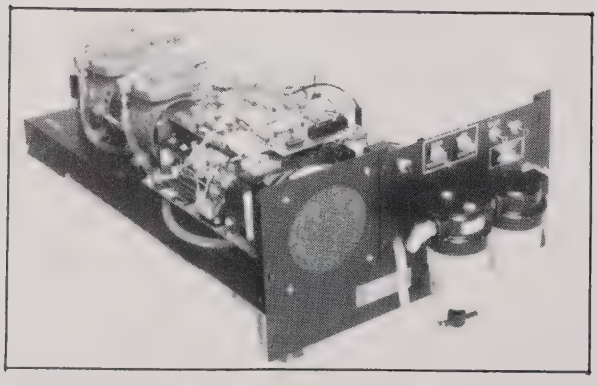


7009-1892 Remote Control Assembly

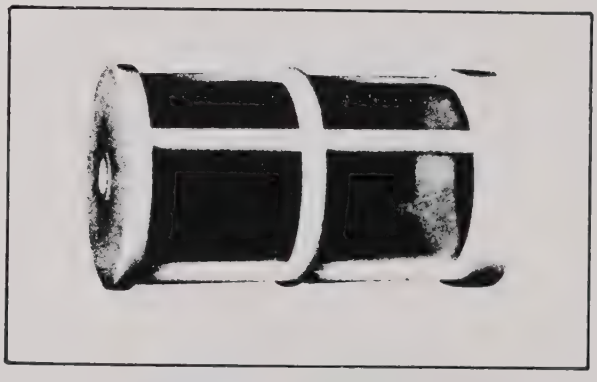
0002-0133-15 Test Lead (not shown)

OPTIONAL

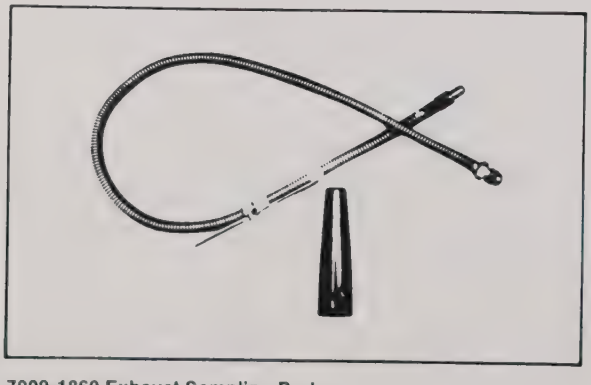
4-Gas Option Includes:



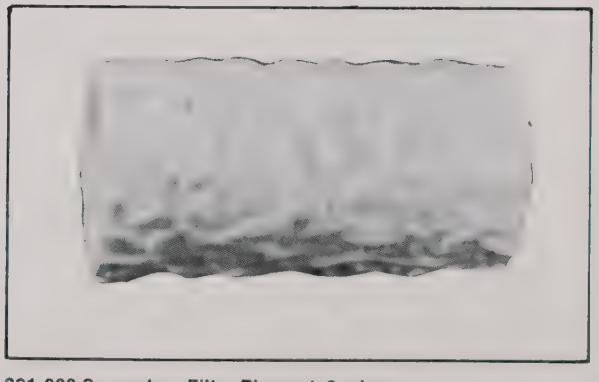
0120-0492 4-Gas Option



301-926 Primary Filter Element, 75 micron

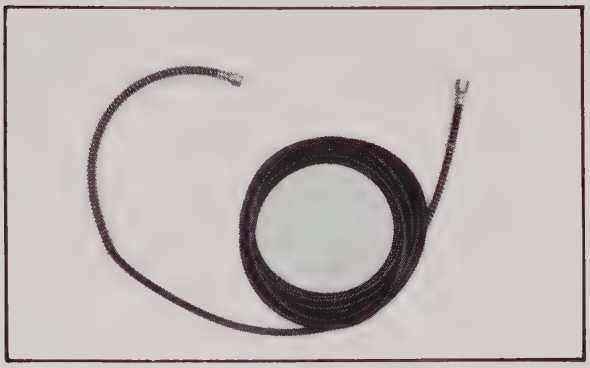


7009-1869 Exhaust Sampling Probe



301-908 Secondary Filter Element, 8 micron

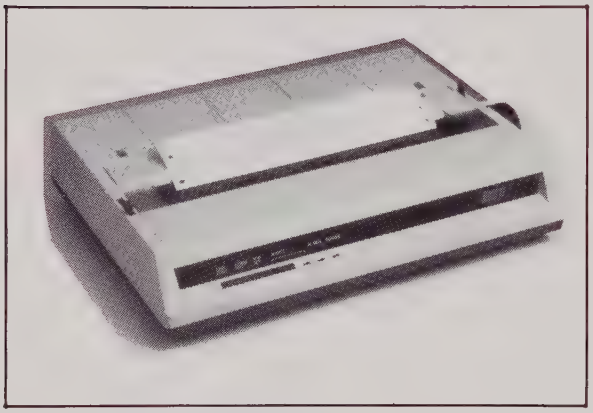
OPTIONAL (continued)



3988-216 Exhaust Sample Hose

7009-1506	Anti Dilution Probe
7009-1730	Leak Check Adapter
7009-1700	Leak Check Adapter
0131-0024	Gas Regulator
7020-1655	Sample Gas Weld Assy.

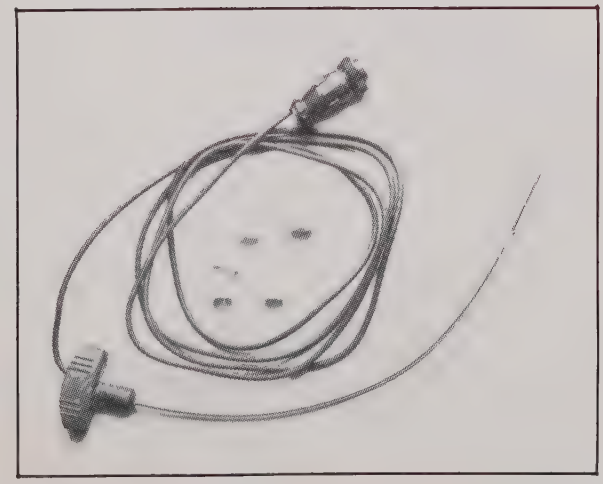
0120-446-01 (OPTIONAL) Gas Calibration Kit (not shown)



AP1000 Printer with 0120-0500 Kit

0528-0994 Printer Paper (not shown)

0528-0995 Ribbon Cartridge (not shown)

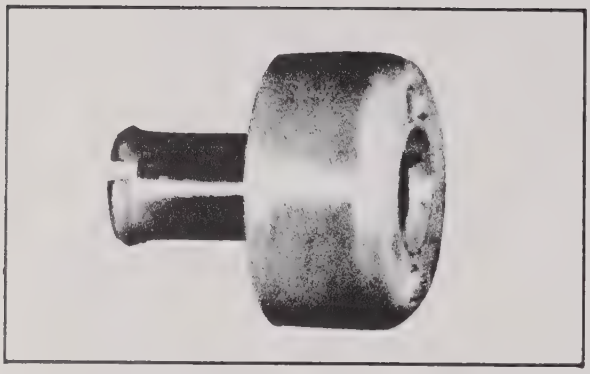


0120-0494 Mag Timing Kit

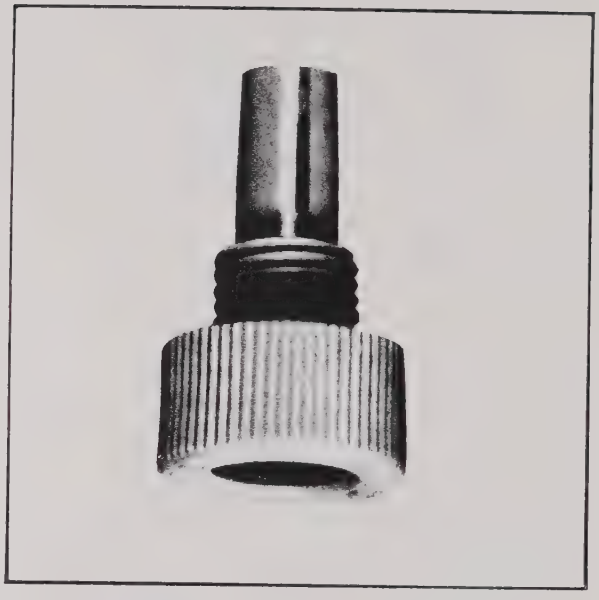
7009-1890 Mag Timing Probe Assy.

OPTIONAL (continued)

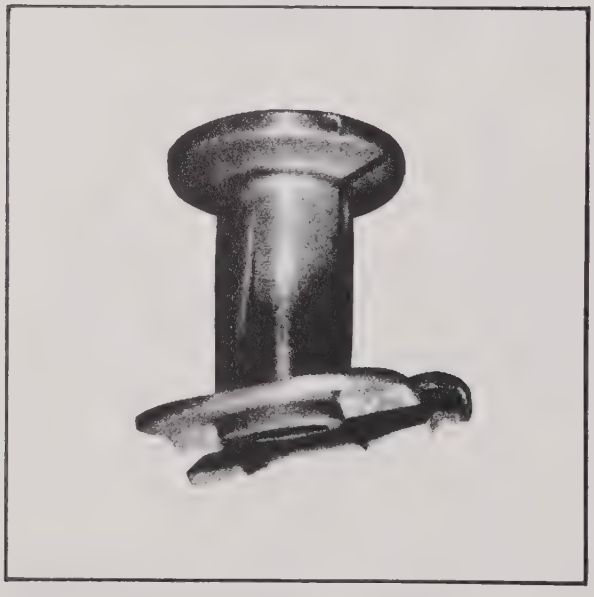
Mag Timing Options:



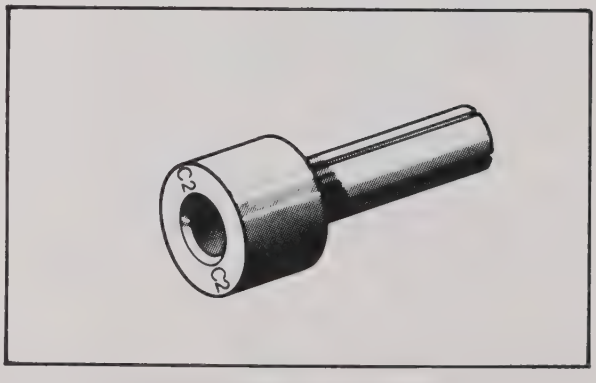
7054-56 Ford Magnetic Probe Adapter, F1



7054-60 Ford Magnetic Probe Adapter, F2

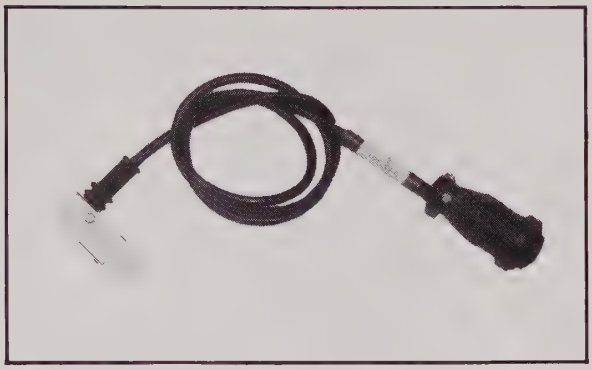


7054-57 Early Chrysler Magnetic Probe Adapter, C1

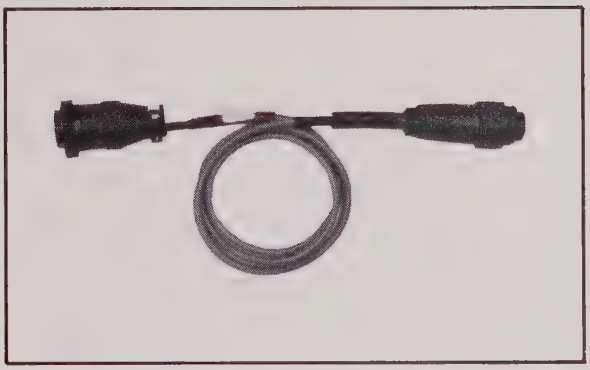


7054-62 Late Chrysler Magnetic Probe Adapter, C2

Optional Mag Timing Test Cable for European Vehicles

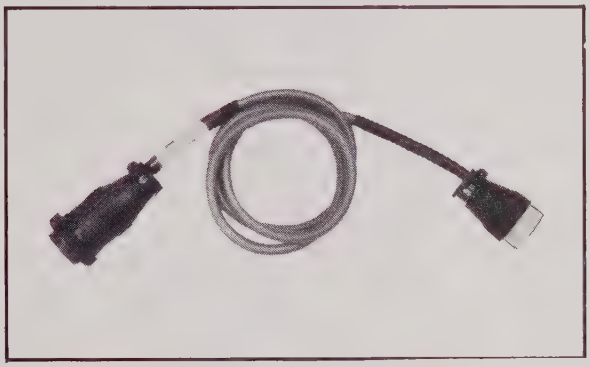


6004-0350 Volvo Mag Timing Probe Adapter Cable

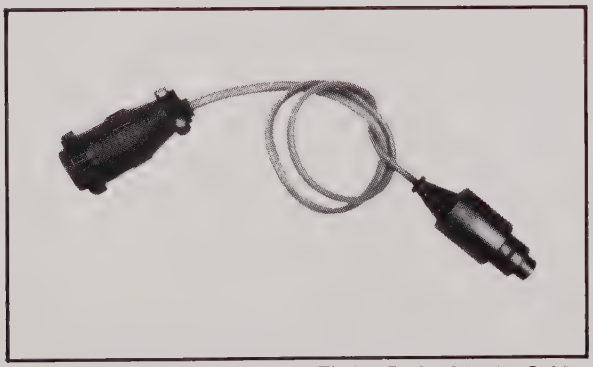


6004-0351 British Leyland/Mercedes Benz Mag Probe Adapter Cable

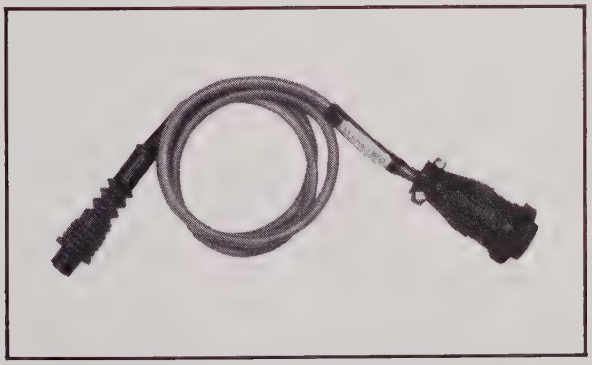
6004-0352 Citroen/Renault/Peugeot Mag Timing Probe Adapter Cable



6004-0353 BMW Mag Timing Probe Adapter Cable

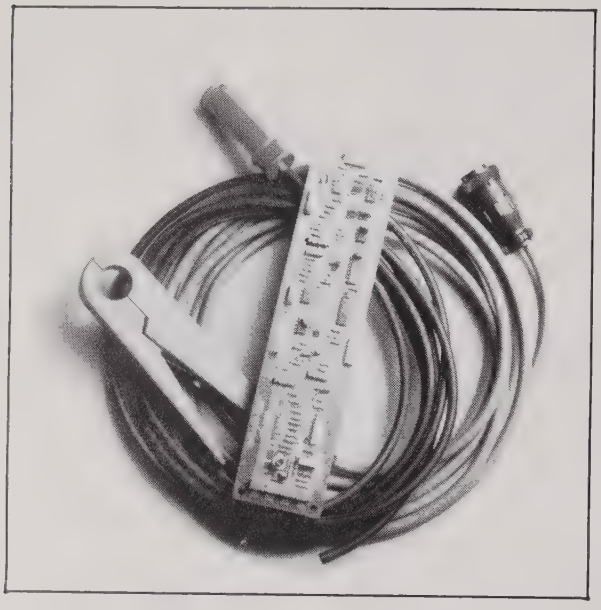


6004-0354 Volkswagen/Audi Mag Timing Probe Adapter Cable



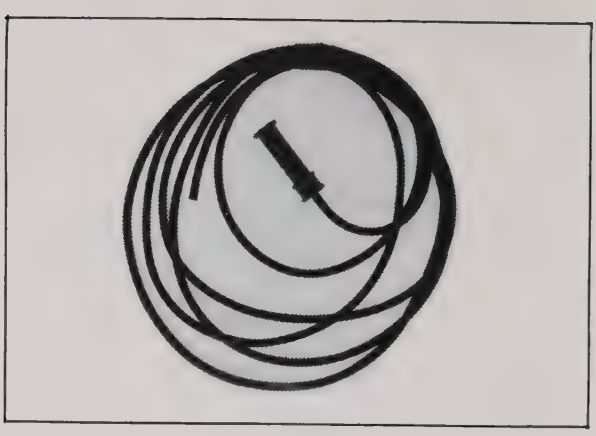
6004-0375 Volkswagen Mag Timing Adapter Cable

OPTIONAL (continued)

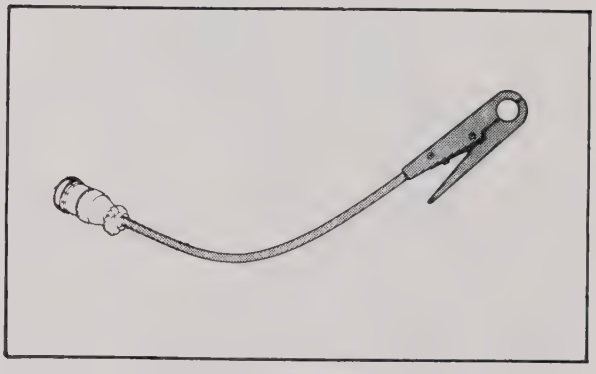


0120-0495 Amps/Vac Kit

Includes:

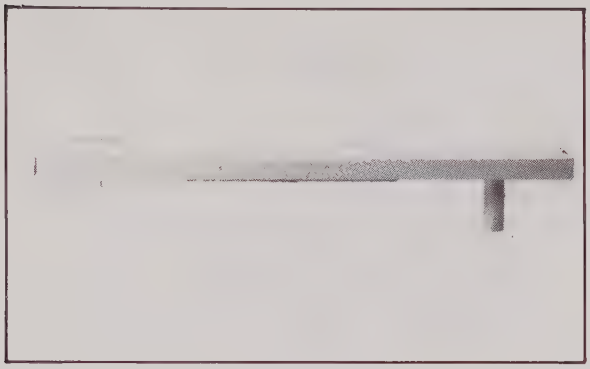


6006-0007 Vacuum Hose Assembly

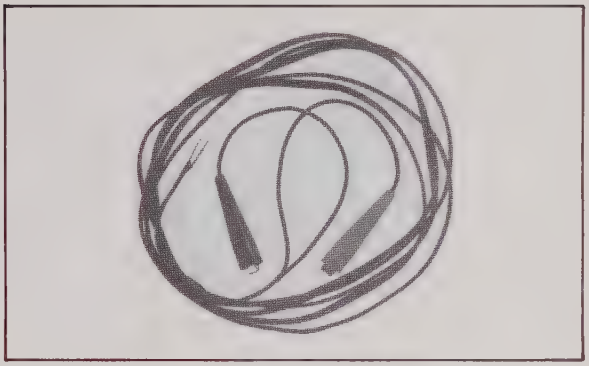


6005-0133-01 Ammeter Lead Assembly

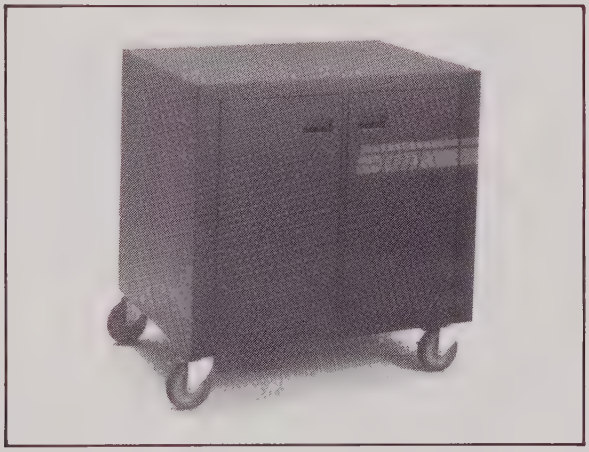
OPTIONAL (continued)



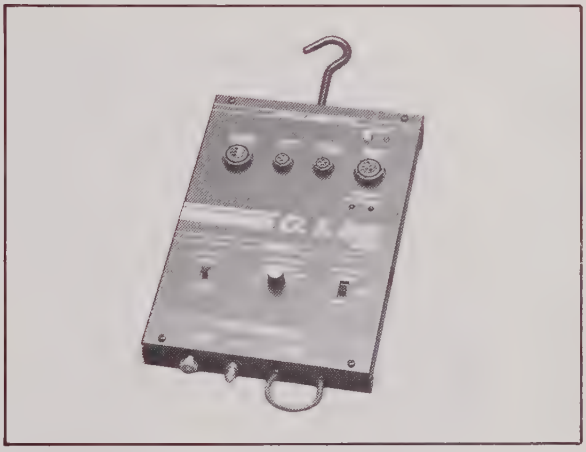
0120-0496 Boom



0120-0497 Coil (+) Capability



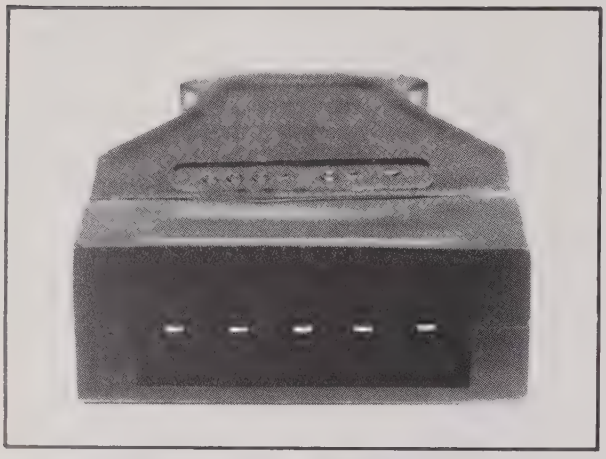
7010-0718 C-34 Test Cabinet



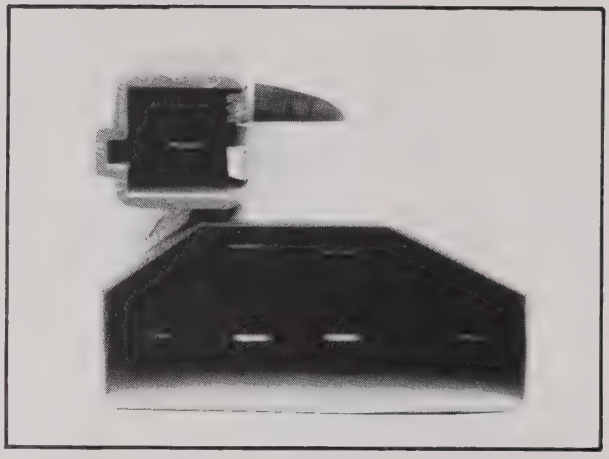
DIL-200 Distributorless Ignition Test Adapter

647-170 Tee Assembly (not shown)

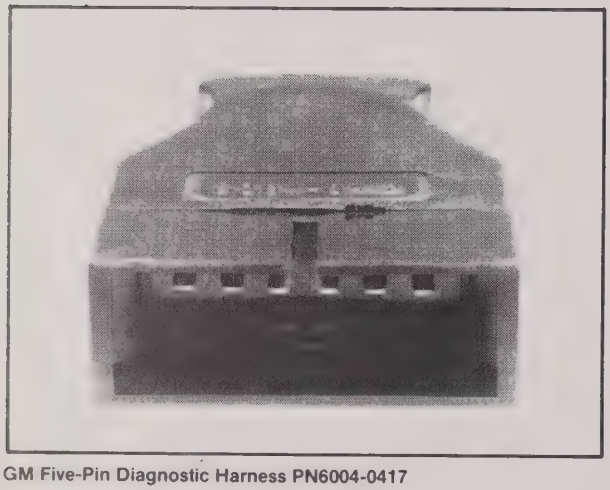
Data Link Accessories



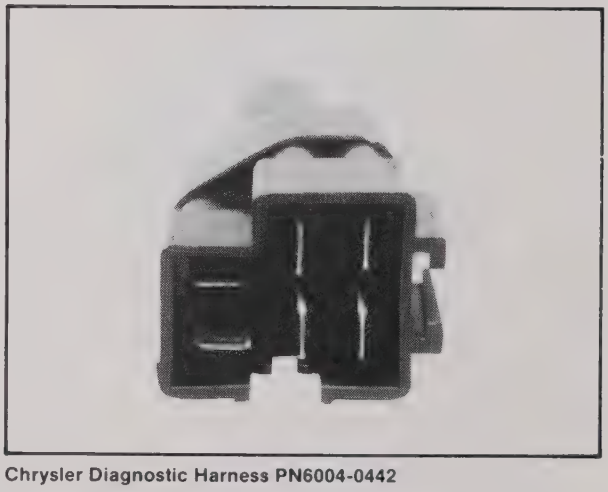
GM Twelve-Pin Diagnostic Harness PN6004-0552



Ford Diagnostic Harness PN6004-0443

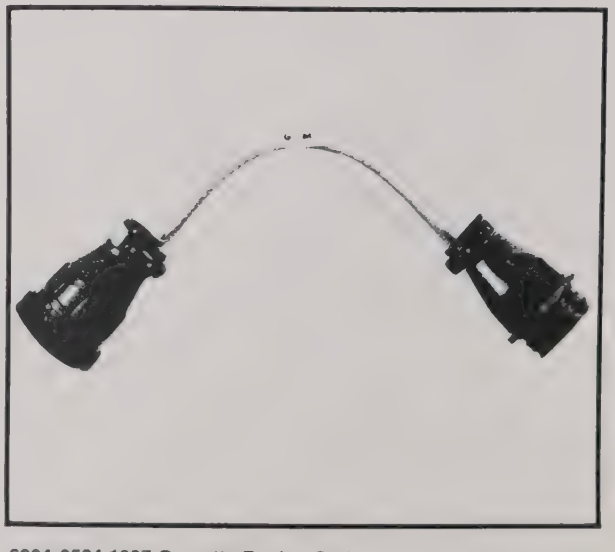


GM Five-Pin Diagnostic Harness PN6004-0417



Chrysler Diagnostic Harness PN6004-0442
Chrysler Adapter Cable 6004-0525 (not shown)

Ford, Chrysler, GM Monitor Disks



6004-0524 1987 Corvette Engine Code
8 Bidirectional Cable (optional)

DATA LINK OPERATING INSTRUCTIONS

General

The Sun Data Link, Model DL-100, shown in Figure 1, interfaces with Ford, Chrysler and General Motors electronic engine control systems. An accessory for the MEA-1500, the Data Link is mounted beneath the MEA's VDU and contains a 3.5 inch floppy disk drive.

Through separate disk programs, the Data Link can sample the system's data stream, provide test routines and display trouble codes. Test capabilities depend on the make and model of the vehicle tested. The applicable Program Guides contain specific information about the operation of each disk.

The Data Link is connected to the vehicle diagnostic connector by a Ford, GM or Chrysler diagnostic harness and operated by the MEA-1500 remote control keypad, which has been expanded to include additional keys and key functions.

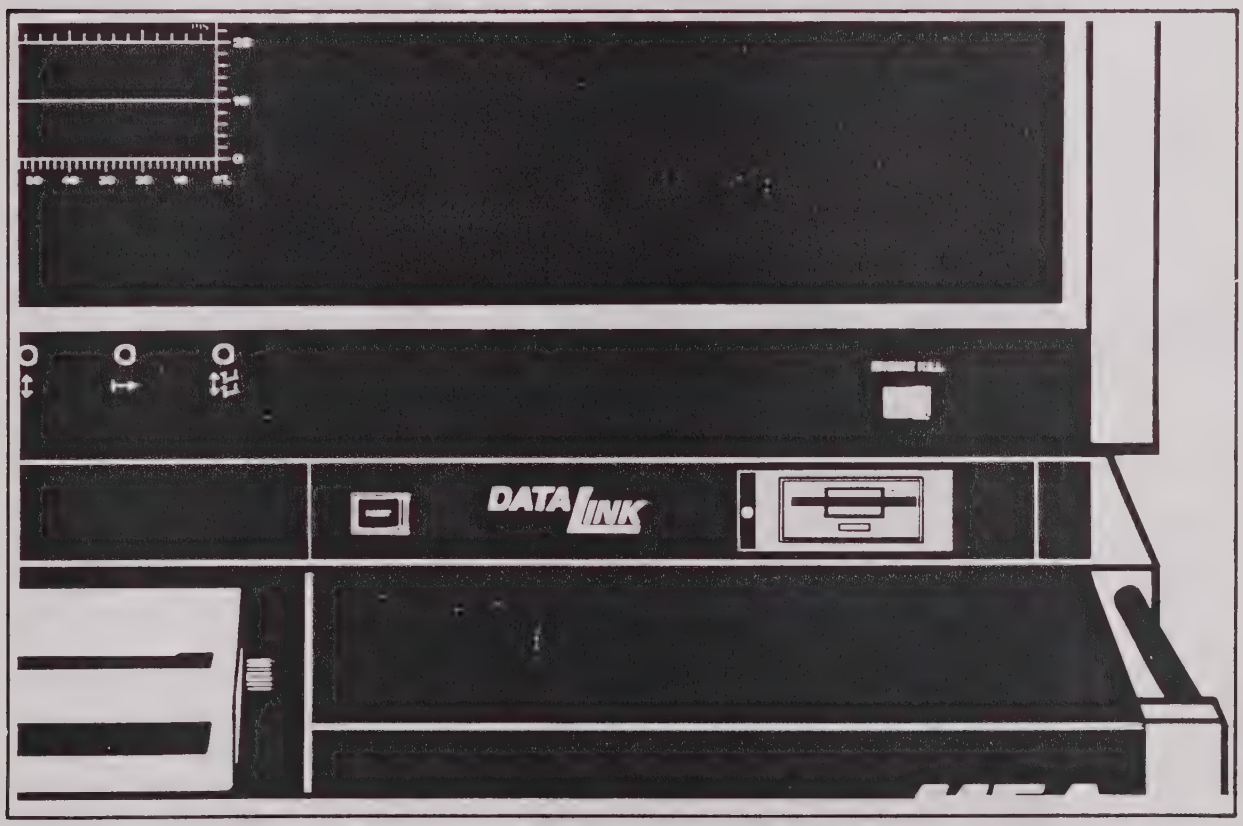


Figure 1. Sun Data Link

Controls

The upgraded MEA-1500 remote control keypad (Figure 2) contains three additional keys and two keys to which functions have been added. These new and modified VDU control keys are described on Page 3.

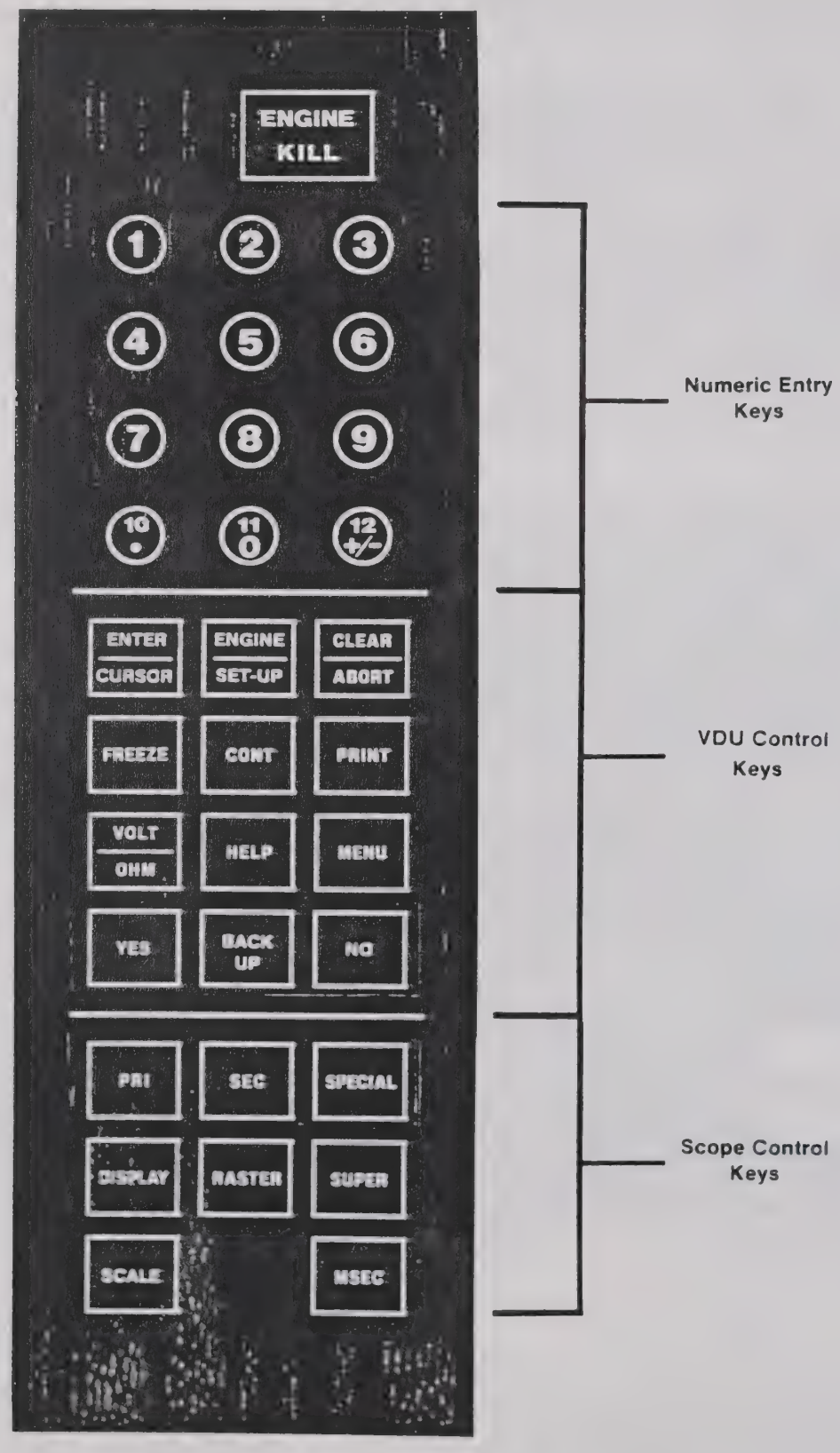


Figure 2. Upgraded Remote Control

ENTER / CURSOR — Dual-function. Use cursor on data entry pages to move the cursor down the page to the next data entry line. Use enter after making a correct numeric selection whenever the word "Enter" is displayed at the bottom of the VDU in the Data Link program.

ENGINE / SET-UP — Dual-function. Use set-up to advance directly to the VEHICLE SET-UP page from MEA pages. Use engine to advance directly to the VEHICLE TEST Page from Data Link pages.

YES — Press this key to answer "Yes" to a (YES/NO) question displayed on the VDU in the Data Link program.

NO — Press this key to answer "No" to a (YES/NO) question displayed on the VDU in the Data Link program.

BACK UP — Press this key to review data or test results on a previous Data Link page. Refer to the backup function section for a detailed explanation of this feature.

Backup Function

The Data Link backup function permits the operator to return to a previous Data Link page to review information or to make different entries or selections. The operator can back up within a test sequence. Once the program moves forward into another sequence, in most cases, the program will not backup past this point.

Program Reset Function

The RESET switch (Figure 9) on the front panel of the Data Link is used to re-start the disk. It may be pressed when changing disks, testing another vehicle, or during testing to start the program over.

Test Preparation And Procedure

Before testing an engine with the Data Link, refer to the manufacturer's recommended procedure for determining if the vehicle problem is caused by failures outside of the electronic engine control system.

Lead Connection

Connect the appropriate diagnostic harness from the connector labeled VEHICLE COMPUTER on the rear of the Data Link to the diagnostic connector on the vehicle to be tested. Ford and Chrysler each use a single standard diagnostic harness for all applications. GM uses either a 5-pin or a 12-pin connector, depending on the year.

1. FORD: Connect the Ford diagnostic harness (PN6004-0443) from the Data Link to the diagnostic connector (Figure 3) located in the engine compartment.
2. CHRYSLER: Connect the Chrysler diagnostic harness (PN6004-0442) and Chrysler adapter cable (PN6004-0525) from the Data Link to the diagnostic connector (Figure 4) located in the engine compartment.
3. GENERAL Motors: Connect the appropriate diagnostic harness as follows, depending on the year of the car. For 1981 GM vehicles, connect the 5-pin diagnostic harness

(PN6004-0417) to the diagnostic connector (Figure 5) located under the dash. For all other GM vehicles, connect the 12-pin diagnostic harness (PN6004-0522) to the diagnostic connector (Figure 6) located under the dash.

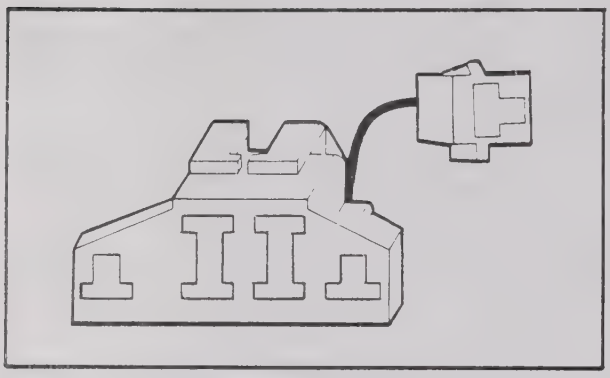


Figure 3. Ford Diagnostic Connector

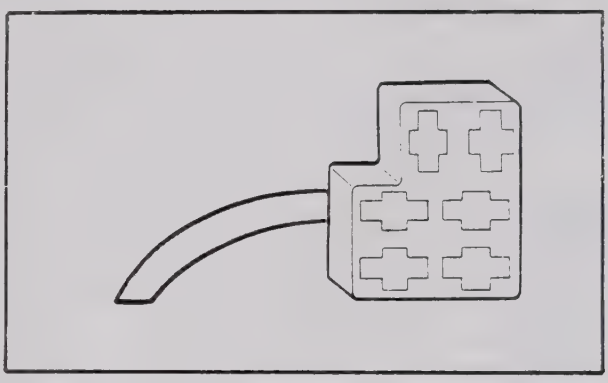


Figure 4. Chrysler Diagnostic Connector

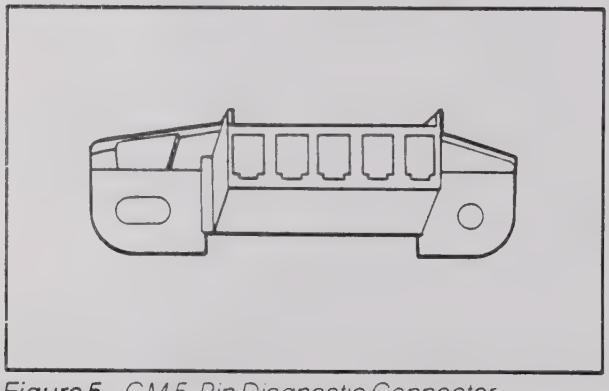


Figure 5. GM 5-Pin Diagnostic Connector

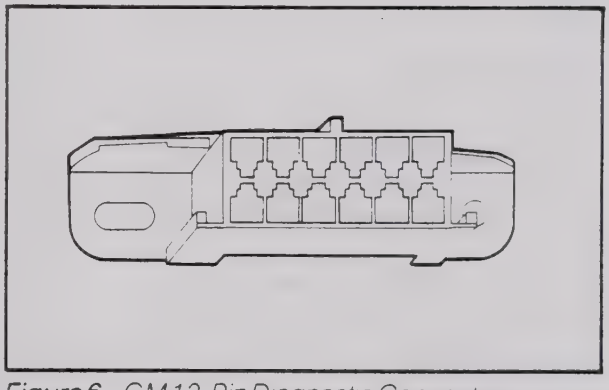


Figure 6. GM 12-Pin Diagnostic Connector

Test Procedure

1. Proceed through the MEA-1500 system check and calibration pages to the PROGRAM MENU page (Figure 7) and select the Data Link function. The DATA LINK TITLE page will be displayed (Figure 8).

2. Slide the disk drive door and insert the metal shutter end of the correct disk for the vehicle make being tested into the slot (label side up). Push in until the disk drive (Figure 9) latches.

3. Follow the instructions displayed on the VDU. For more specific information about the operation of each disk, refer to the Program Guide for the disk being used.

4. During disk operation, it is possible to leave the Data Link program at any point and select other MEA functions.

   A. Press the ENGINE/SET-UP key to advance directly to the VEHICLE TEST page.

   B. Press the MENU key to return to the PROGRAM MENU page and select other MEA functions (ie. power balance, vehicle set-up, etc.).

C. Press the CONT key to return from MEA pages to the Data Link page which was previously left.

5. MEA scope, print and freeze functions are operative during the Data Link program. Scope settings will appear in reverse video at the top of Data Link pages. It will not be possible to select individual cylinder scope displays while in the Data Link mode. Individual cylinder scope displays are available from the Vehicle Test page.

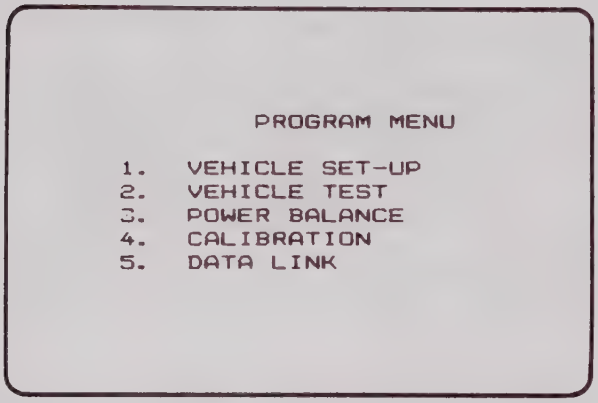


Figure 7. Program Menu Page

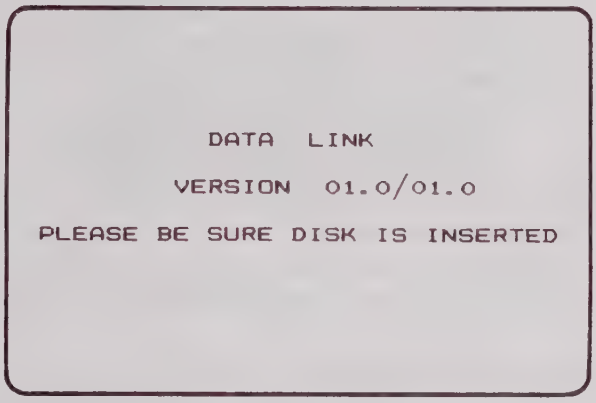
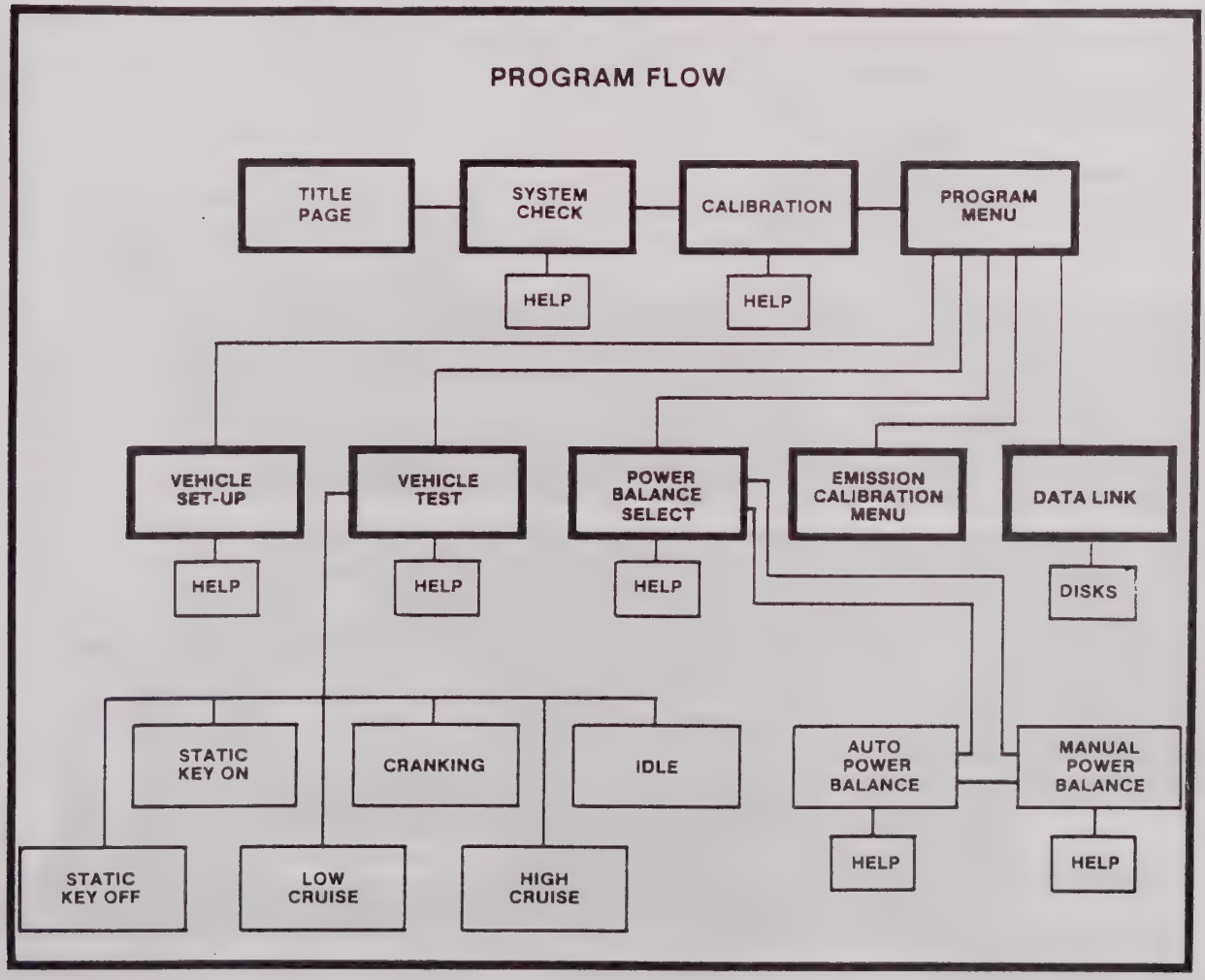


Figure 8. Data Link Title Page



After Testing

1. Disconnect the Data Link diagnostic harness.

2. Press the disk release (Figure 9) and remove the disk. Return it to the disk sleeve in the MEA-1500 three-ring binder.

3. Press the MENU key to return to the PROGRAM MENU page, or turn power OFF.

   NOTE: It is recommended that the disk be removed from the Data Link before power is turned off.

Routine Maintenance

Test Lead Maintenance

The diagnostic harnesses will retain their new appearance if they are cleaned periodically with waterless, non-abrasive hand cleaner and wiped dry.

Care And Maintenance Of Disks

Disks should be kept clean and dry, and should be stored in the disk sleeve when not in use.

CAUTION: Magnetic materials, such as magnetized screw drivers, electric motors, coils, HEI distributors, etc., should be kept away from the disks, which can be ruined with a magnet.

Maintaining Tester Finish

The Data Link has a stain-resistant baked enamel finish, which should be polished with automobile wax and periodically wiped with a damp cloth.

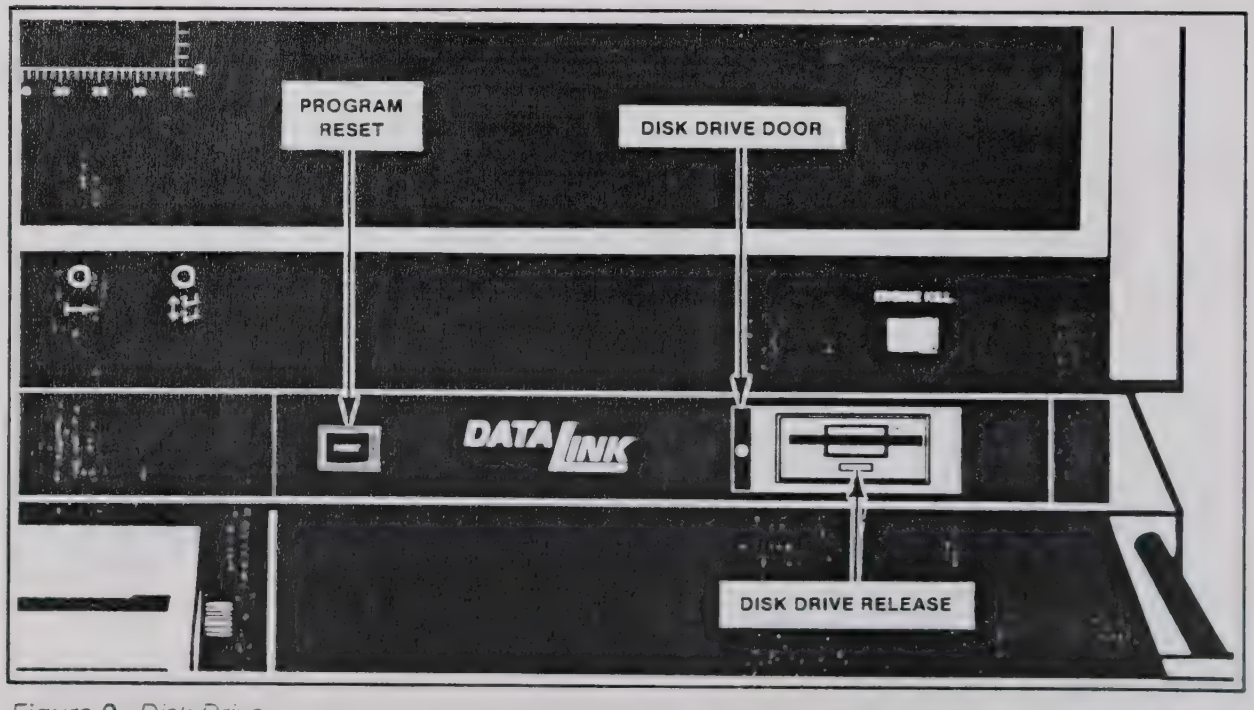
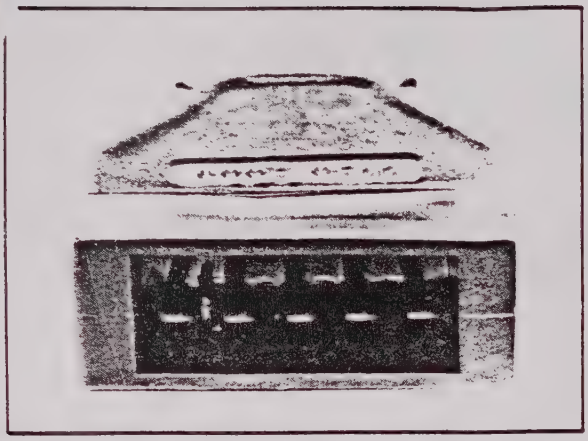
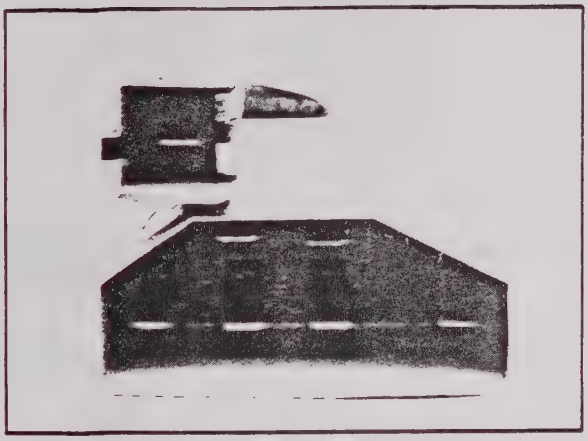


Figure 9. Disk Drive

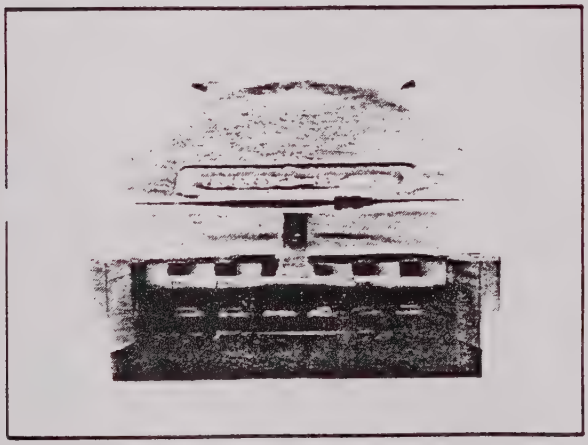
Accessories



GM Twelve-Pin Diagnostic Harness PN6004-0552



Ford Diagnostic Harness PN6004-0443



GM Five-Pin Diagnostic Harness PN6004-0417

Ford, Chrysler, GM Monitor Disks (not shown)

Chrysler Diagnostic Harness PN6004-0442

Chrysler Adapter Cable 6004-0525 (not shown)

SUN ELECTRIC
CORPORATION

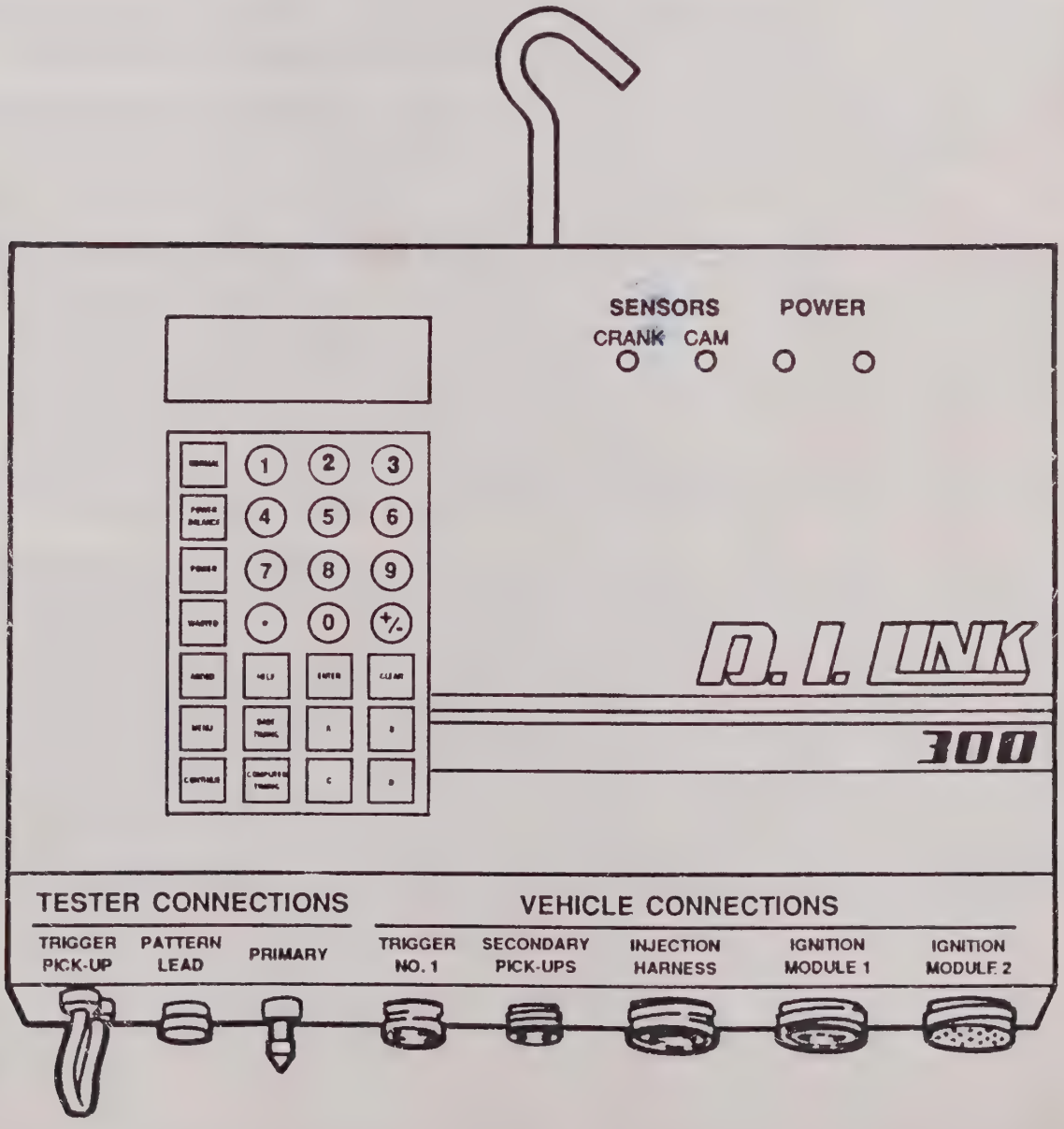
692-1489 (7860)

©1987 Sun Electric Corporation

Printed in U.S.A.

DIL 300

OPERATING INSTRUCTIONS



Contents

SAFETY PRECAUTIONS 2

INTRODUCING SUN'S DIL 300 4

UNIT FEATURES 5

THE BASICS - GETTING STARTED 7

ALL VEHICLE SECONDARY (AVS) 9

GM PERSONALITY CARTRIDGE 12
- Optional Accessory 20
- Cam And Crankshaft Application Chart (GM) 21

FORD PERSONALITY CARTRIDGE 22
- Cam And Crankshaft Application Chart (Ford) 28

CHRYSLER PERSONALITYCARTRIDGE 29

DISTRIBUTORLESS IGNITION SYSTEMS OVERVIEW 33
- Theory of D.I.S. Operation 33
- General Motors Systems 34
- C3I Type I, II, III 34
- D.I.S. Direct Ignition System 35
- I.D.I. Integrated Direct Ignition 36
- Ford DIS and EDIS 37
- Comparing EDIS and DIS 37
- Similarities 37
- Differences 37
- Ford Distributorless Ignition Applications 38

DIAGNOSTIC AND TESTING GUIDELINES 40
- Incorrect Cylinder Polarity Symptoms 40
- Power Mode 43
- Wasted Mode 44
- Added Mode 45
- Dynamic Spark Duration/Dynamic Spark KV 46
- Dynamic KV Compare Mode 47
- Dynamic KV Compare Mode -- Scope Displays 48
- Coil Oscillations 49
- Cam and Crankshaft Sensor LED's 50
- General Rules 49

QUICK REFERENCE GUIDE 50

SAFETY PRECAUTIONS

The DIL 300 is a highly sophisticated test instrument. It is intended for use by properly trained, skilled professional automotive technicians. The safety warnings and cautions presented below and throughout the remainder of the operator's manual are reminders to the operator to exercise care when using this test instrument.

Because of the vast number of test applications and variations in the products which can be tested with this instrument, Sun Electric Corporation cannot possibly anticipate or provide safety warnings or cautions to cover every situation. It is the automotive technician's responsibility to be knowledgeable of the circuit or system that is to be tested, and to perform tests in an appropriate and acceptable manner that does not endanger personal safety, the safety of others in the work area, the vehicle, or equipment being tested.

Before using the DIL 300, always refer to and folllow the safety warnings, cautions and applicable tests procedures provided by the manufacturer of the vehicle or equipment that is to be tested.

READ THIS OPERATOR'S MANUAL COMPLETELY BEFORE USING THE DIL 300.

1. Always work in properly ventilated areas - exhaust gases contain carbon monoxide, a colorless, odorless lethal gas.

2. Wear safety goggles to protect eyes from acid, dust, gasoline, and objects that may fly off of moving parts.

3. Do not smoke around gasoline. Always stop leaks, wipe up gasoline spills immediately, and dispose of soaked rags in air tight containers.

4. Do not test a vehicle low on fluids. Check the engine oil level and add oil if necessary before testing. Check the coolant level. Do not open a closed coolant system while the fluid is hot.

5. Do not wear loose clothing or ties near an operating engine. Keep hands and hair away from moving engine parts such as fan blades, belts, or pulleys. Never wear watches, rings, or other jewelry when working on a vehicle. These items may catch on moving parts or create electrical short circuits that could cause burns.

6. Do not operate the timing light too closely to fans or belts because it may make the fan seem to stand still — a dangerous optical illusion that may cause accidental contact with the fan.

7. Use caution when working around fuel delivery systems. Never look directly into the carburetor throat when cranking or tuning the engine. Backfire may cause burns. Never pour gasoline down the carburetor or throttle body while attempting to start the engine. Use caution when opening any fuel line. Many systems, fuel injection in particular, maintain residual pressure in the line after the vehicle is turned off.

8. Avoid contact with hot surfaces such as exhaust manifolds and pipes, mufflers, catalytic converters, radiators, and hoses.

9. Use caution when working around batteries. Do not lay tools or equipment on the battery. Accidental battery terminal shorting may cause shocks or burns and damage wiring or the battery itself. Battery acid can damage clothing and burn skin and eyes. If battery acid contacts skin, wash with water and use baking soda to neutralize the acid. If acid splashes into eyes, rinse with water and contact a doctor immediately. Flame or sparks near the battery may cause it to explode.

10. Keep a fire extinguisher in the work area. The extinguisher should be suitable for gasoline, chemical, and electrical fires.

11. Always use insulated pliers when handling ignition system components while the engine is running. High voltage is present in the secondary ignition system.

12. Place wheel chocks both in front of and behind the drive wheels before testing a vehicle.

13. Avoid working around electric cooling fans while the engine is hot. These fans can turn on without warning, even while the ignition system is off.

14. Remove tools from the engine compartment before starting the engine. Tools or other objects that fall into fan blades or drive belts can be thrown out and strike the operator.

15. Use auxiliary shop lights carefully. Make sure bulb protectors are intact and that only rough service bulbs are used. Route power cords outside the engine compartment.

16. To prevent electrical shock, do not remove covers. There are no user serviceable parts inside the analyzer. Refer all servicing to your local Sun Customer Service Representative.

17. Do not place liquids on top of the unit. If liquid or any other foreign matters enters the cabinet, it could cause electrical shock or damage. Unplug the unit immediately if you think that liquid or any other foreign matter has entered it. Then have it checked by qualified personnel.

FOR SERVICE: 1-800-CALL-SUN

INTRODUCING SUN'S DIL 300

Distributorless ignition systems are being used on today's cleaner-burning and fuel-efficient engines. Instead of a conventional distributor and coil, distributorless ignition systems consist of a combined ignition and coil module and various sensors; all are connected to some type of electronic control module (ECM) by an engine harness. The coils are double-ended and most common DIS equipped vehicles fire pairs of cylinders simultaneously.

The DIL 300 allows the operator to test vehicles equipped with these ignition systems. The DIL 300 also provides the operator with the flexibility of performing power balance tests, secondary ignition tests or full function tests for complete diagnostics when interfaced with Sun's MEA 1400, MEA 1500, Interrogator 2 or the MCA 3000.

The modular design of the DIL 300 allows each shop to purchase personality cartridges for the type of vehicles that are serviced the most. Available cartridges include:

General Motors Personality Cartridge - P/N 7009 2055 2
Ford Personality Cartridge P/N 7009 2055 3
Chrysler/Eagle/Mitsubishi Personality Cartridge P/N 7009 2055 1

The DIL 300 is operated and programmed by an alphanumeric key pad with an LCD display that features a menu for ease of operation. The DIL 300 has a built in test feature known as ALL VEHICLE SECONDARY (AVS) capability, or AVS. This feature allows the operator to retrieve secondary information from the test vehicle without the use of a personality cartridge through the secondary ignition hookups of the DIL 300 and the host tester.

Sun's DIL 300 has the capability of interfacing with 4, 6, 8, and 10 cylinder distributorless ignition vehicles.

The DIL connects to the vehicle to gather operating information which is displayed on your Sun engine analyzer. Operator prompts make setting up the DIL 300 for the ignition system under test easy and fast. This manual covers operating basics for the DIL 300 including the optional Ford, GM and Chrysler personality cartridges. Testing guidelines and distributorless ignition background information are also covered.

UNIT FEATURES

POWER SWITCH AND INDICATOR LIGHT (A):

The power switch on the DIL 300 is a normally open safety switch. After the DIL is connected to the vehicle's 12-volt battery, press the power switch ON. The LED next to the power switch will light, indicating the unit is powered up and ready to be programmed.

Note

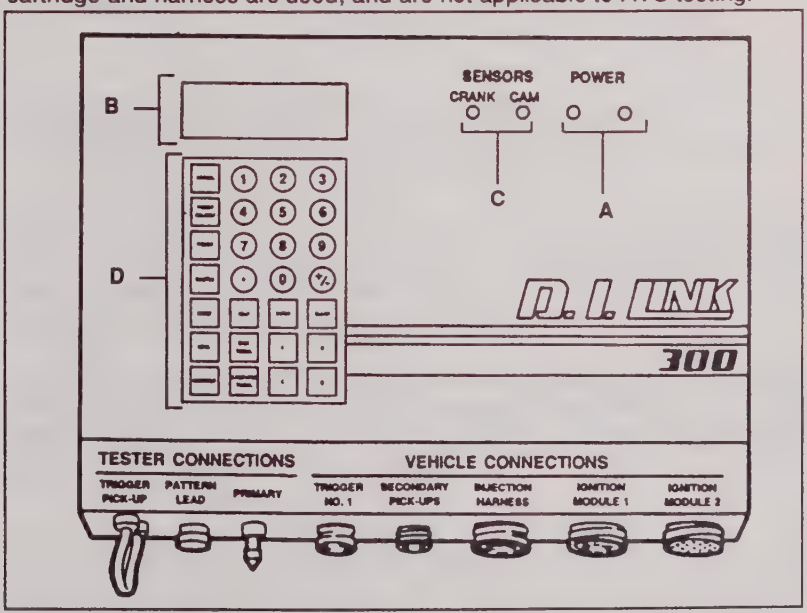
The DIL 300 must be ON for the vehicle to start.

LCD DISPLAY (B):

When used with the keypad, it allows you to select the number of cylinders, firing order, coil polarity, as well as selection of either, wasted, power or added secondary patterns.

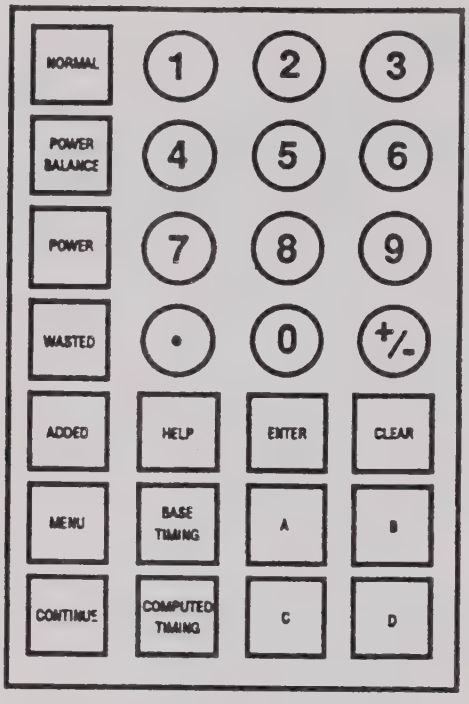
CAM AND CRANK SENSOR LED's (C):

The crank or cam sensor LED's blink during testing, indicating that the sensors are sending signals to the vehicle's ECM. These LED's function only when a cartridge and harness are used, and are not applicable to AVS testing.



ALPHA/NUMERIC KEYPAD (D)

ENTER	Enters a numeric selection.
CLEAR	Clears a numeric selection.
HELP	Displays supplementary information for the current display.
CONTINUE	Returns to program from help screens



MENU	Returns to first screen; engine selection menu for cartridges; firing order entry screen for AVS.
POWER	Select the power stroke mode of KV display.
WASTED	Selects wasted stroke mode of KV display.
ADDED	Selects added mode of KV display.
C	Moves cursor LEFT
D	Moves cursor RIGHT
+/-	Enters the firing polarity of each cylinder.
NORMAL	For all test applications except power balance.
POWER BALANCE	For power balance testing only.
BASE TIMING	For Ford cartridge use only, when using a timing light.
COMPUTED TIMING	For Ford cartridge use only, all applications except timing light.
A, B	For future use.

To use the DIL 300, perform the following simple steps:

1. Power Up The Analyzer

Power up the Sun analyzer as directed in the operator's manual and follow the prescribed warm-up and calibration procedures.

For the MCA	Identify the vehicle being tested; set the TRIGGER control to AUTO.
For the 1805Z	Enter the correct vehicle code for the vehicle being tested; set the ignition selector to the number 2 position.
For the MEA	Enter the number of cylinders. The magnetic timing offset angle and the number of cylinders will remain preset at 0.0 degrees and 4 cycles, respectively.

2. Connect The Analyzer Leads To The DIL

Perform the following connections from your Sun engine analyzer to the DIL 300 in the area marked TESTER CONNECTIONS

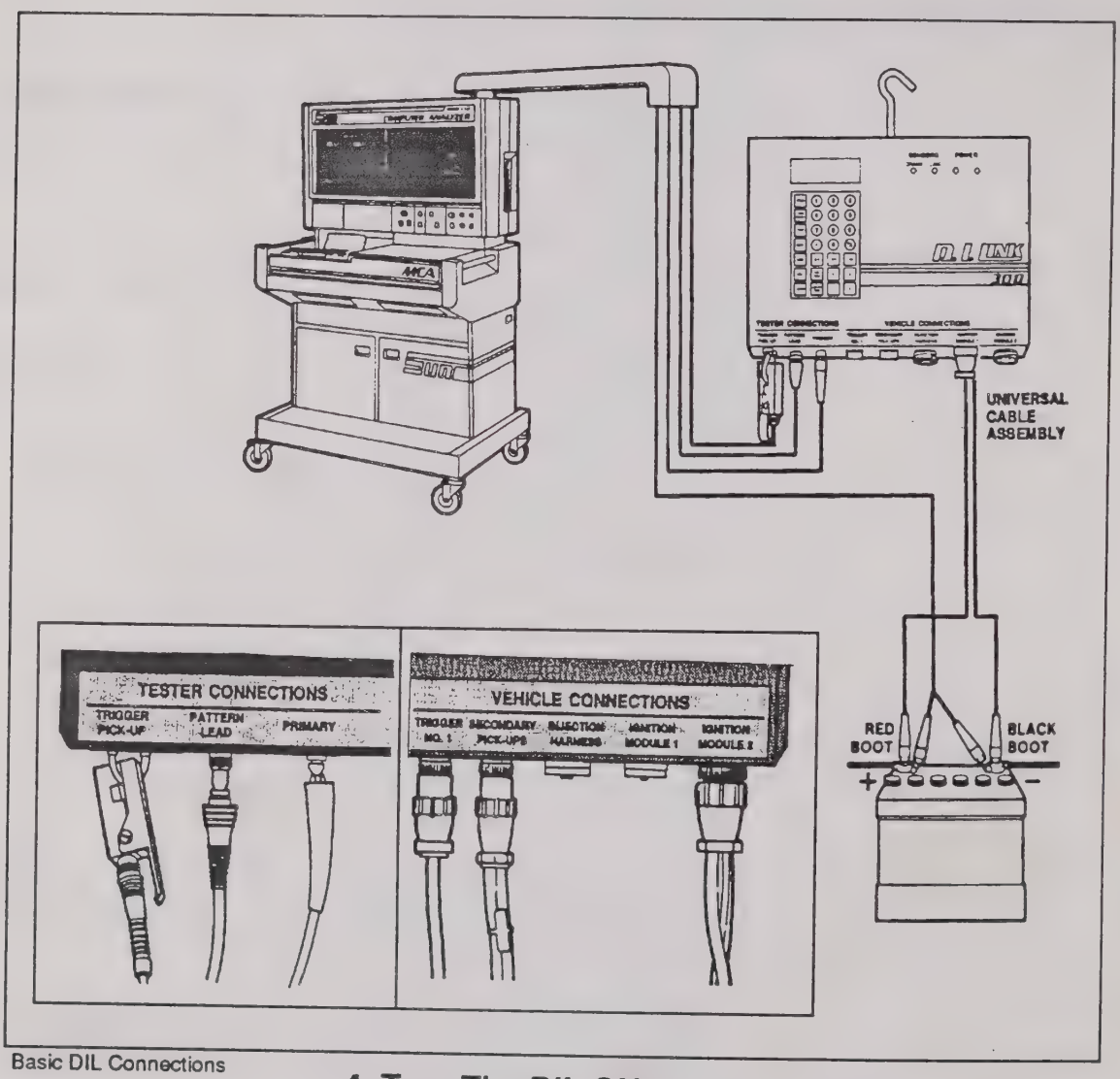
Clamp the RED trigger pickup around the TRIGGER PICKUP loop on the DIL 300. Connect the BLUE primary lead to the PRIMARY post on the DIL 300. Remove the pattern pickup from the end of the BLUE pattern lead, and connect the lead to the PATTERN LEAD connector on the DIL.

The coil + lead will not be used if the tester is equipped with one. Connect the remaining leads, amp clamp, vacuum, temperture and battery leads for the host tester to the vehicle. The host tester and DIL battery leads should be connected at the same point. See illustration.

3. Connect The Universal Harness (U1 or U)

Connect the universal harness ("U" or "U1") to the DIL at the ignition module connector. Consult the quick reference guide to determine which universal harness is required for the vehicle under test. The "U" harness has a round 14-pin connector and attaches to the DIL at the connector labeled IGNITION MODULE 1. The "U1" harness has a round 28-pin connector and attaches to the DIL at the connector labeled IGNITION MODULE 2.

Connect the battery leads from the universal cable to the vehicle's battery - - -RED to positive, BLACK to negative. See illustration.



Basic DIL Connections

4. Turn The DIL ON

Press the power switch to turn the unit on. If applicable, select a personality cartridge for the vehicle to be tested. Consult the Quick Reference Guide for the applications which are supported by GM, Ford, Chrysler or Mitsubishi cartridges. If a cartridge is not inserted, the DIL will automatically default to AVS testing.

You're Now Ready For Vehicle-Specific Test Procedures. Go To Page 9 for AVS testing; Page 12 for GM Cartridge Testing; Page 22 for Ford Cartridge Testing; and page 29 for Chrysler Cartridge testing.

ALL VEHICLE SECONDARY (AVS)

Secondary ignition testing is a quick and convenient way to qualify secondary KV's on distributorless ignition systems. The AVS feature is built into the DIL 300 and does not require a personality cartridge to be installed to perform secondary KV testing. The DIL 300 will automatically default to AVS testing. AVS allows the operator to retrieve scope patterns or dynamic KV data by **connecting only the secondary pickups, #1 trigger pickup and the battery leads** from the universal harness, without interfacing with the vehicles module or ECM. Using the DIL 300 in AVS mode provides secondary information on four, six, eight and ten cylinder distributorless eguipped vehicles.

Note **Cylinder Power Balance and Ignition/Engine Kill will not function in AVS testing mode. Be sure that you have completed the steps in "The Basics -- Getting Starting" before proceeding.**

To perform AVS testing:

1. Enter The Firing Order

Enter the engine's firing order via the keypad on the DIL. Press ENTER when complete. Consult the quick reference guide, or manufacturer manuals for this information.

```
ENTER FIRING ORDER
1 2 3 4 5 6
```

2. Enter Cylinder Polarities

Enter the cylinder polarity under the cylinder's number using the +/- key. The "D" key moves forward to next entry; the "C" key moves to the left to change an entry. Press ENTER when complete. Consult the quick reference guide for polarity information. If the firing polarities are not listed for the engine being tested, use the procedure in Testing Guidelines section to determine them.

```
ENTER + - PATTERN
1 2 3 4 5 6
- + + + - -
```

3. Enter The Trigger Lead Cylinder

Enter the cylinder number of the spark plug wire the RED trigger pickup will be connected to, usually cylinder no. 1.

RED TRIGGER LEAD
IS ON CYLINDER #
1

4. Connect The RED Trigger Pickup

Attach the trigger lead to the DIL at the connector labeled TRIGGER NO. 1. Clamp the RED trigger pickup around the spark plug wire of the cylinder entered as the trigger lead cylinder.

5. Connect The Secondary Pickups

Attach the secondary pickup lead to the connection labeled SECONDARY PICKUPS on the DIL. Clamp the secondary pickup with the RED BAND to the positive firing spark plug wires. Clamp the other secondary pickup around the negative firing spark plug wires. These wires were identified on the cylinder polarity screen.

Note **The DIL 300's secondary pickups are spring-loaded; both pickups must be closed tightly around each set of spark plug wires, to insure an accurate sensing of secondary signals. The pickup wires should be parallel, not crossed.**

If the secondary pickups cannot be clamped around all of the plug wires due to their length or placement on the engine, use the secondary "Y" adapter (PN 6004-0628-1) and a second set of pickups. Disconnect the secondary pickup lead from the DIL and connect the "Y" adapter in its place. This allows you to use two sets of secondary pickups; it is not necessary to use all four pickups. As long as the plug wires are placed in the correct polarity pickup, the DIL will operate correctly.

It is vital that the plug wires are connected to the correct polarity (RED-BLACK) pickup. If the correct polarities are not observed, the DIL will not function properly.

6. Press The NORMAL Key

For all AVS testing, press NORMAL on the DIL keypad.

7. Select Host Tester Scope Screens, KV Pages Or Complete Test

Depending on your preferences and analyzer capabilities, choose the desired scope display or digital KV test page on the host tester screen. You can also perform the analyzer's complete test.

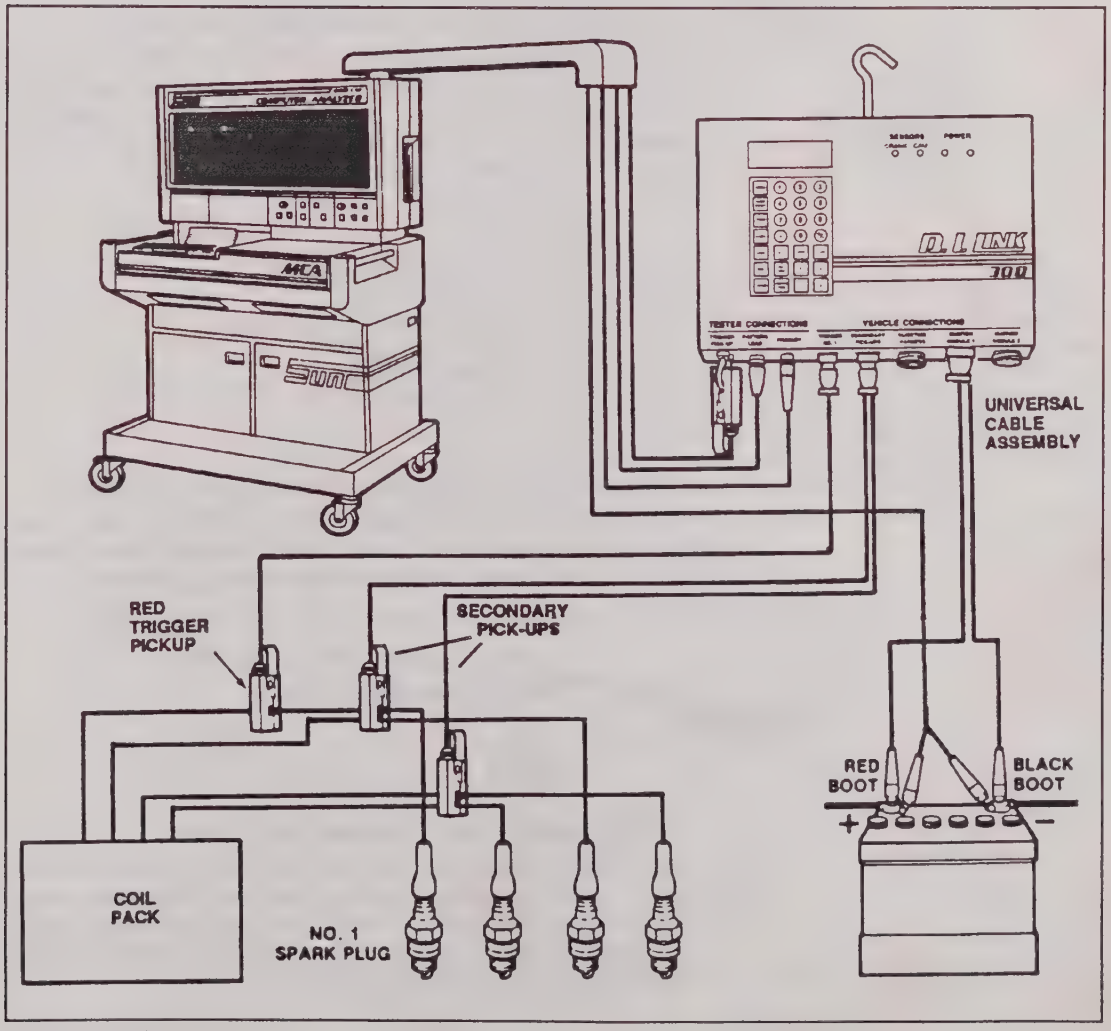
8. Select KV Display Mode

For KV testing, press the keypad to select either "ADDED", POWER", or "WASTED" mode of KV display. Refer to the Testing Guidelines section for instructions on how to diagnose problems with each display mode.

ADDED: The wasted and combustion (power spark) summed together. Added is the preferred setting for the complete test sequence on all host testers.

WASTED: The secondary KV firing of the cylinders on the exhaust stroke of the engine.

POWER: The secondary KV firing of the cylinder compression or power stroke.



DIL Connections

GM PERSONALITY CARTRIDGE

Sun's DIL 300 General Motors personality cartridge allows the technician to perform comprehensive testing on most GM vehicles with distributorless ignition systems, including Computer Controlled Ignition (C3I), Direct Ignition Systems (DIS), Integrated Direct Ignition (IDI) and Indirect Ignition Systems (IDIS). The DIL 300 uses special harnesses to connect with the various ECM's and ignition modules found on GM's distributorless ignition vehicles. When the technician uses one of these harnesses the CAM and Crank sensor LED's will be active, depending on the vehicle application. (Refer to the Quick Reference Guide for harness applications).

Note

Be sure that you have completed the steps in "The Basics – Getting Starting" before proceeding.

To Perform GM DIS Vehicle Testing:

1. Insert The GM Personality Cartridge

General Motors Personality Cartridge is attached to the RIGHT SIDE of DIL 300 by inserting the cartridge into the receptacle and gently pushing until it locks in place. When the DIL is powered up, a menu is displayed in the LCD window. Program the DIL 300 for the vehicle being tested by using the keypad to respond to the items displayed in the LCD window.

```
1. GM 2.8L
2. GM 3.0L
3. GM 3.1 W BODY
4. GM 3.1L
```

2. Select The Application To Be Tested

An application menu is displayed in the LCD window. Identify the exact GM system to be tested. The DIL 300 will automatically display the part number of the module harness required for the vehicle application.

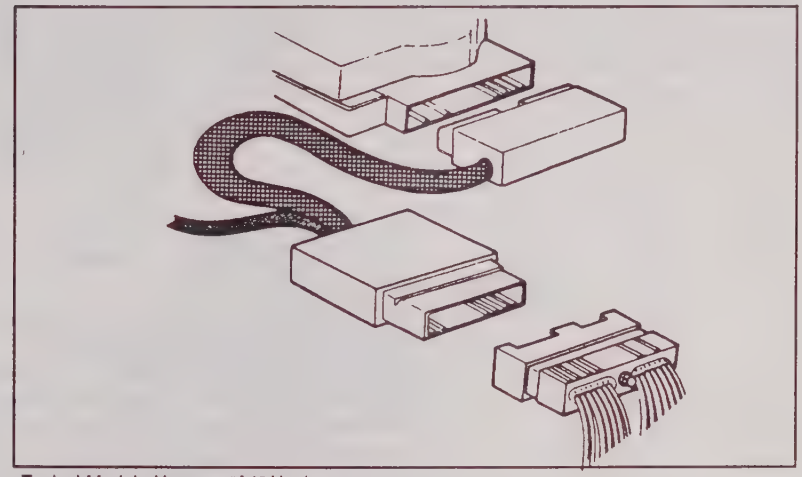
```
FOR COMPLETE TESTS
USE HARNESS NO.:
      C1
```

3. Connect The Module Harness

Depending on the engine displacement, one of four module harnesses is used. The DIL 300 will prompt you to use the appropriate harness. Refer to the Quick Reference Guide. Each has a round connector which is attached to the UNIVERSAL CABLE (U1) connector which attaches to the IGNITION MODULE 2 under VEHICLE CONNECTIONS.

Module Harness "A1": 3.0L TYPE I, 3.3L, 3.8L Type I 3.8L TYPE II.

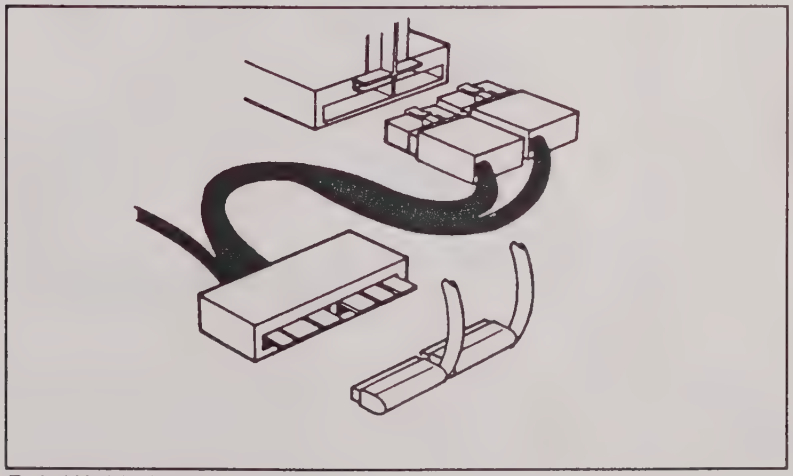
To connect module harness "A1", disconnect the 14-pin connector which is plugged into the ignition module by loosening the retaining bolt and gently pulling. Plug the complementary connector from the module harness into the ignition module, and engine's 14-pin connector into the module harness receptacle. Refer to the figure for typical hookup using module harness "A1".



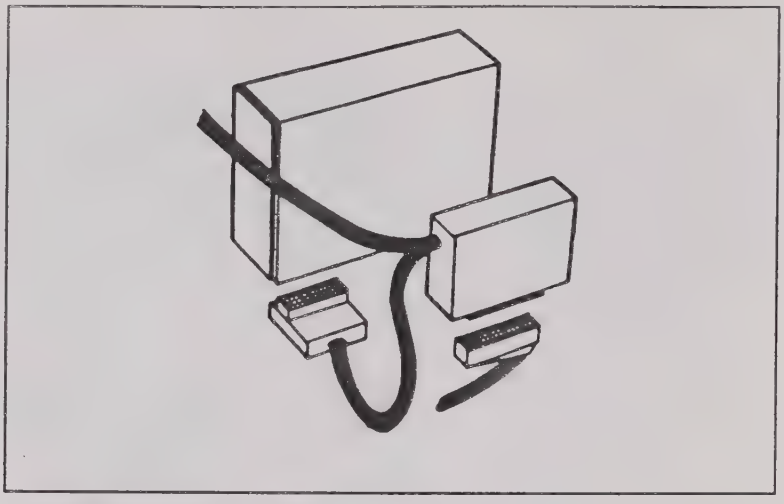
Typical Module Harness "A1" Hookup.

Module Harness "B1": 2.0L, 2.2L, 2.5L

To connect module harness "B1", disconnect the WHITE 24-pin connector and the BLACK 24-pin connector of the engine harness from the Electronic Control Module (ECM) located behind the glove box. ECM locations may vary; consult the appropriate GM service manuals or component locator chart for exact locations. Plug the complementary WHITE and BLACK connectors of the module harness into the ECM, and attach both engine harness connectors just removed to the single complementary module harness connector. Refer to the figure for a typical hookup, using module harness "B1".



Typical Module Harness "B1" Hookup.

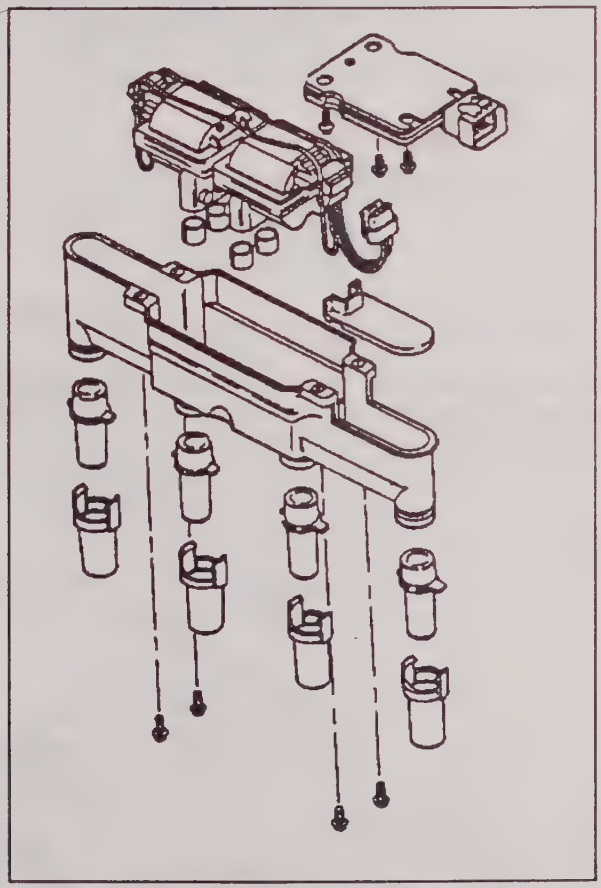


Typical Module Harness "C" Hookup.

Module Harness "C1": 2.0L, 2.3L Quad 4, 2.8L except W Body, 3.1L except "W" body, 3800 TYPE III.

To connect module harness "C1", disconnect the BLACK or GRAY 32-pin connector of the engine harness from the Electronic Control Module (ECM) located behind the glove box panel. ECM locations may vary; consult the appropriate GM service manuals or component locator chart for the exact location. Plug the complementary GRAY or BLACK 32-pin connector of the module harness into the ECM, and the engine harness connector into the module harness receptacle. Refer to the figure for a typical hookup, using module harness "C1".

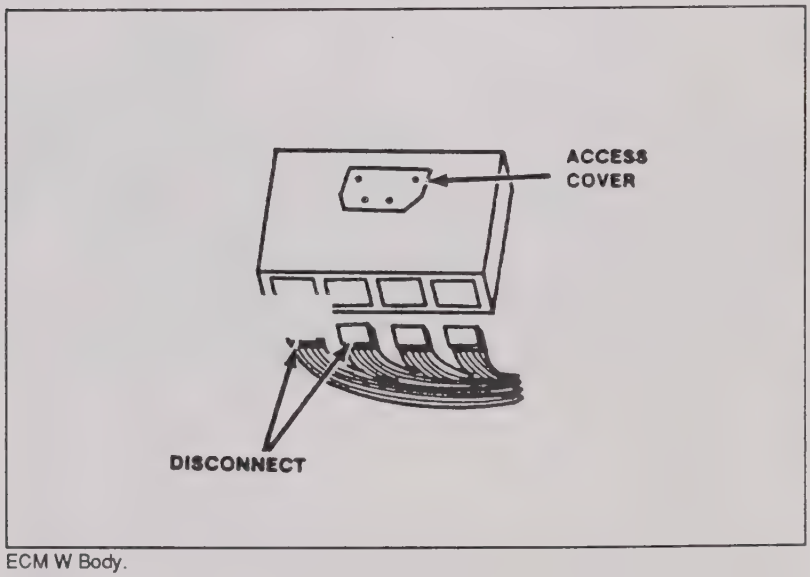
The Quad 4 Engine has no spark plug wires, therefore an ignition test harness -- GM J-36012 or equivalent -- must be used to allow secondary connections. To connect to the Quad 4 engine remove the four bolts that hold the ignition assembly in place. Do not disconnect the harness connector to the module. Turn the assembly upside down and use two bolts to hold it in place on the camshaft housing. Place a shop rag between the ignition assembly cover and the camshaft housing to prevent the cover from being scratched. Connect the ignition system test harness between the spark plug connector assemblies and spark plugs. The spark plug connector assemblies should be left attached to the coil towers. Refer to the Lead Hookup Chart and follow the hookup instructions for harness "C1".



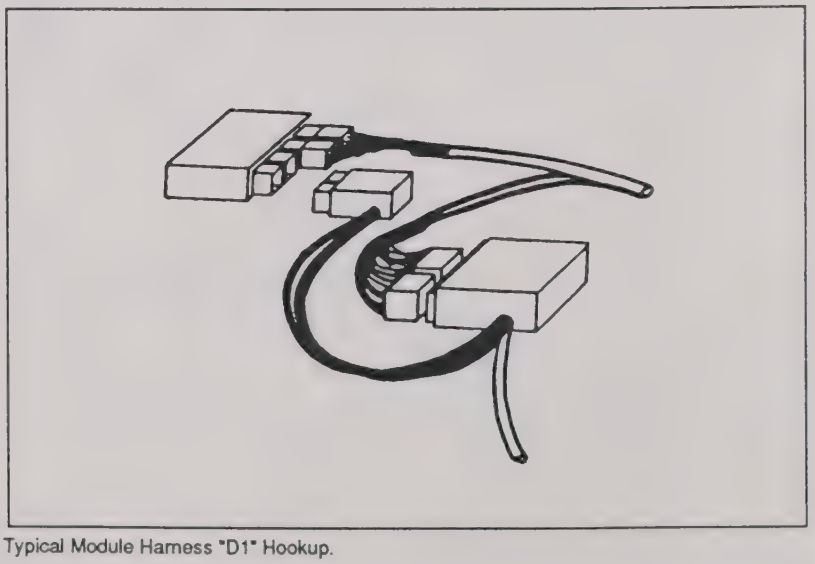
I.D.I. Quad 4 Exploded View

Module Harness "D1": 2.5L W Body, 2.8L W Series, 3.1L 1989-90 W Body.

The figures below detail a typical hookup using module harness "D". The ECM on W body vehicles is located in front of the right shock tower. Remove the ECM from its holding bracket by loosening the three mounting nuts. Lay the ECM flat on the fender surface on a protective covering. Remove the cover surrounding the four engine harness pigtail connectors, which are plugged into the ECM. Disconnect the BLUE and GRAY (or GREEN) 22-pin pigtail connectors, which are side-by-side on the left side of the ECM. The other pigtails are not disconnected. Plug the complementary BLUE and GRAY (or GREEN) connector from module harness "D1"into the ECM, and the two engine harness pigtail connectors just removed into the YELLOW module harness receptacle.



ECM W Body.



Typical Module Harness "D1" Hookup.

4. Connect The RED Trigger Pickup

When the correct module harness is connected, the DIL will automatically identify the trigger lead cylinder. If the harness is not connected, you will be prompted to identify the trigger cylinder. Attach the trigger lead to the DIL at the connector labeled TRIGGER NO. 1. Clamp the RED trigger pickup around the spark plug wire, which the DIL has identified as the trigger lead cylinder.

5. Connect The Secondary Pickups

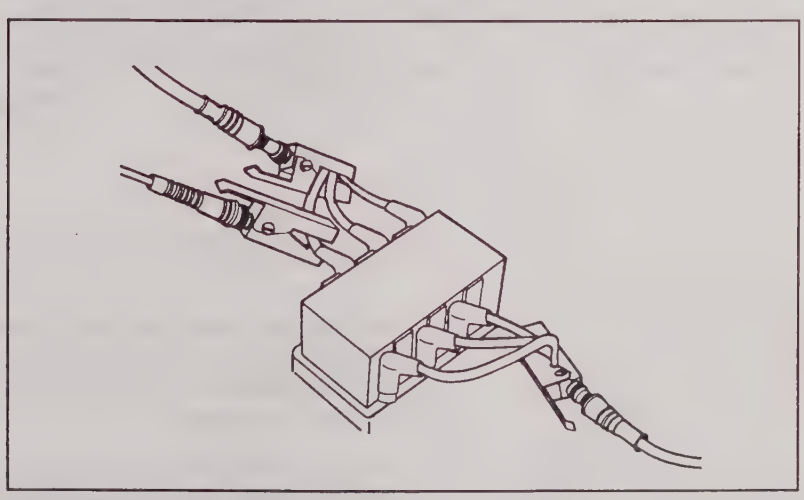
Identify the positive (EVEN) negative (ODD) wires for the GM system to be tested from the Quick Reference Guide. Consult the GM service manuals for additional information. Not all (-) are odd or all (+) are even. When using the cartridge, the help screen will indicate the firing order and polarity (+) or (-).

THE FIRING ORDER AND POLARITIES ARE:

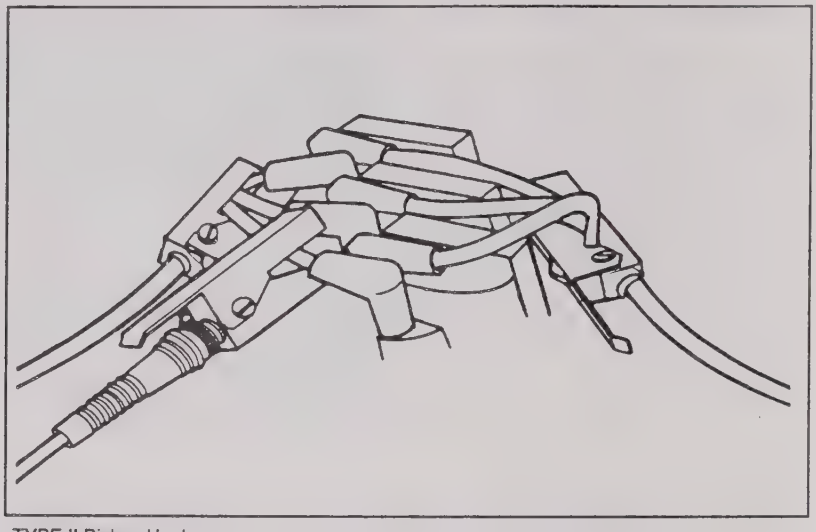
1 6 5 4 3 2

+ - + - + -

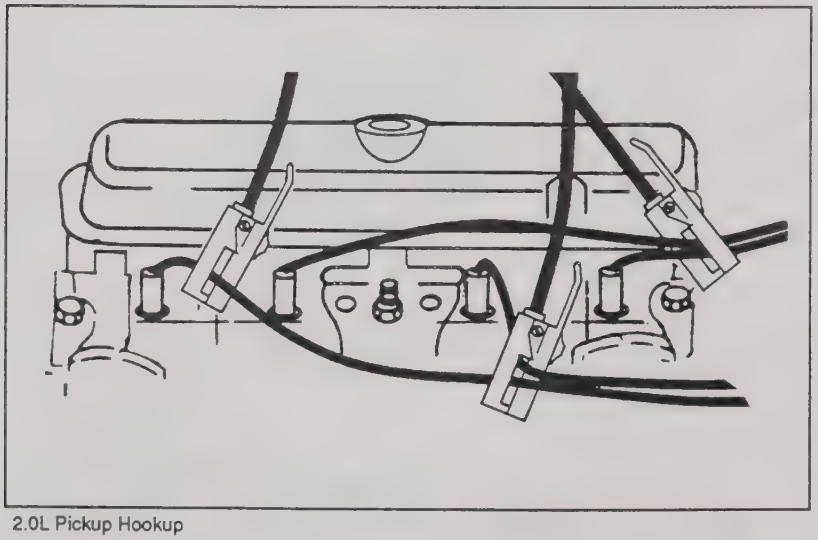
On 2.8L, 3.0L and 3.8L TYPE I, II and III systems, pickups are attached near the ignition module. On 2.0L, 2.2L, 2.5L, 3.1L and 3.3L engines, the pickups are attached close to the spark plug wires where the wires are accessible. Refer to the following figures for examples of typical hookups.



TYPE I Pickup Hookup



TYPE II Pickup Hookup



2.0L Pickup Hookup

Note The DIL 300's secondary pickups are spring-loaded; both pickups must be closed tightly around each set of spark plug wires, to insure an accurate sensing of secondary signals. The pickup wires should be parallel, not crossed.

The plug wires must be connected to the correct polarity (RED or BLACK) pickup. If the correct polarities are not observed, the DII will not function properly. Refer to the Testing Guidelines section for more information.

6. Select Host Tester Scope Screens, KV Pages Or Complete Test

Depending on your preferences and analyzer capabilities, choose the desired scope display or digital KV test page on the host tester screen. You can also perform a Complete Test, if your analyzer is so equipped.

7. Select KV Display Mode

For KV testing, press the keypad to select either "ADDED", POWER", or "WASTED" mode of KV display. Refer to the Testing Guidelines section for instructions on how to diagnose problems with each display mode.

ADDED: The wasted and combustion (power spark) summed together. Added is the preferred setting for the complete test sequence on all host testers.

WASTED: The secondary KV firing of the cylinders on the exhaust stroke of the engine.

POWER: The secondary KV firing of the cylinder compression or power stroke.

8. Press NORMAL Or POWER BALANCE

If you are peforming power balance tests, press the POWER BALANCE key on the DIL keypad. For all other testing, press NORMAL.

9. Check the CAM And Crank LED's

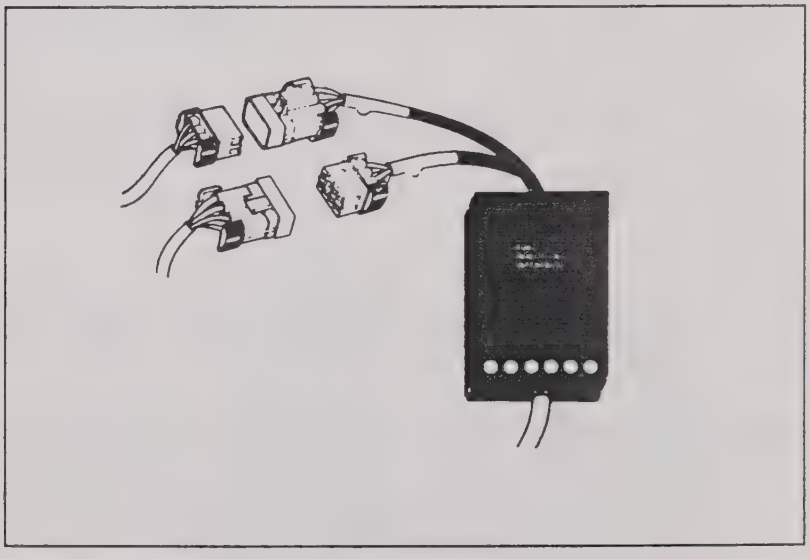
The respective sensor light will blink, indicating that the sensor is sending signals to the electronic control module. Refer to the application chart on page 21. For further information, also refer to distributorless ignition overview.

OPTIONAL ACCESSORY

Injection Harness: For pre-1990, TYPE II 3.8L and TYPE III 3800 Systems Only

Connect the round connector of the fuel injector harness to the connector labeled INJECTION HARNESS under VEHICLE CONNECTIONS. Disconnect the vehicle's 7-pin fuel injector harness, which may be located by following wires from the fuel injectors. Next, connect the two connectors of the DIL's injection harness to their complementary connectors on the vehicle harness.

The fuel injector lights will blink (one for each of the six fuel injectors), indicating the ECM is sending signals to the fuel injectors.



Injection Harness Hookup (PN# 7009-1866)

CAM AND CRANKSHAFT APPLICATION CHART (GM)

ENGINE	IGNITION TYPE	SENSOR TYPE
2.0L, 2.5L, 2.8L 3.4L, 3.1L, 2.2L	DIS	Crank Only
2.3L	IDI	Crank Only
3.0L	C31 - I	Cam and Crank - Both sensors are combined into one unit called a combination sensor.
3.1L	DIS	Crank Only
3.3L	C3I	Combination Sensor
3.8L 3.8l Turbo	C3I - I, II	Cam and Crank
3800	C3I - III	Cam and Dual Crank Sensor

GM MODULE HARNESSES

Module Harness (A1) PN# 7009 1867 3

Module Harness (B1) PN# 7076 0598 1

Module Harness (C) PN# 7076 0599 1

Module Harness (D1) PN# 7009 1969 2

FORD PERSONALITY CARTRIDGE

Sun's DIL 300 Ford Personality Cartridge allows you to perform comprehensive testing on all Ford vehicles with Distributorless Ignition System (DIS) and Electronic Distributorless Ignition System (EDIS) for both Low Data Rate (LDR) and High Data Rate (HDR) engines. The DIL 300 uses special cables to interface with coil packs and ignition modules on the vehicle for testing. Instructions for using the Ford Personality Cartridge, Ford interface cables, Ford applications by system and engine size are detailed in this section. When the technician uses one of these harnesses the CAM and CRANK sensor LED's will be active based on vehicle application. (Refer to the Quick Reference Guide for harness applications).

Note **Be sure that you have completed the steps in "The Basics – Getting Starting" before proceeding.**

To Perform Ford DIS Vehicle Testing:

1. Insert The Ford Personality Cartridge

The Ford Personality Cartridge is attached to the RIGHT SIDE of DIL 300 by inserting the cartridge into the receptacle and gently pushing untill it locks in place. When the DIL is powered up, a menu is displayed in the LCD window. Program the DIL 300 for the vehicle being tested by using the keypad to respond to the items displayed in the LCD window.

```
1. FORD 1.9L
2. FORD 2.3 DUAL PLUG
3. FORD 3.0L SHO
4. FORD 3.8L SC
```

2. Select The Application To Be Tested.

An application menu is displayed in the LCD window. Identify the exact Ford system to be tested. The DIL 300 will automatically display the part number of the module harness required for the vehicle application.

```
FOR COMPLETE TESTS
USE HARNESS NO.:
      E1
```

3. Connect The Module Harness

The DIL 300 will prompt you to use the appropriate harness. Refer to the Quick Reference Guide. Each has a round connector which is attached to the UNIVERSAL CABLE (U1) connector which attaches to the IGNITION MODULE 2 under VEHICLE CONNECTIONS.

DIS Module Harness — 2.3L

Connect the round connector of the Universal Cable Assembly (U1) to the IGNITION MODULE 2 input under VEHICLE CONNECTIONS on the DIL 300. Connect the rectangular end of the U cable to the complementary connector on the Interface Cable. Connect the other end of this cable to DIS Cable Assembly (E).

When testing the 2.3L and 3.0L engines, disconnect the engine harness at the DIS module (pins #1 through #6). Connect the female end of the SHORT leads of the DIS cable assembly to the DIS module and the male lead to the harness connector. Consult applicable manuals to identify pin number locations of the engine harness. The DIS module is located either at the top front or the right side of the engine.

When testing the 3.8L engine, disconnect the harness at the DIS module (pins #1 through #6). Connect the SHORT leads as per the procedure above. Also, disconnect the harness at pins #7 through #12 on the DIS module. Connect the female end of the LONG leads of the DIS cable assembly to the DIS module and the male lead to the engine harness connector. Consult the applicable vehicle manuals to identify pin number location on the DIS engine harness.

EDIS Module Harness — 1.9L

Connect the round connector of the Universal Cable Assembly (U1) to IGNITION MODULE 2 input under VEHICLE CONNECTIONS on the DIL 300. The 1.9L EDIS module is located on the left inner fender. Connect the rectangular end of the U1 cable to the complementary connector on the EDIS Cable Assembly (F). Disconnect the engine harness from the EDIS module at the front of the vehicle in the engine compartment. Connect the male end of the EDIS cable assembly into the EDIS module; and the engine harness male end into the female end of the EDIS cable. Set the switch on the female end to the correct engine selection.

4. Connect The RED Trigger Pickup

When the correct module harness is connected, the DIL will automatically identify the trigger lead cylinder. If the harness is not connected, you will be prompted to identify the trigger cylinder. Attach the trigger lead to the DIL at the connector labeled TRIGGER NO. 1. Clamp the RED trigger pickup around the spark plug wire, which the DIL has identified as the trigger lead cylinder.

5. Connect The Secondary Pickups

Identify the positive and the negative wires for the Ford system to be tested from the Quick Reference Guide. Consult Ford service manuals for their locations.When using the cartridge, the help screen will indicate the firing order and polarity (+) or (-).

THE FIRING ORDER AND POLARITIES ARE:
1 6 5 4 3 2
+ - + - + -

2.3L DUAL PLUG LDR
On the 2.3L Dual Plug, two secondary pickup assemblies (with two pickups each) are required, one for the primary coil pack circuit and one for the secondary coil pack circuit. Connect the primary and secondary coil pack leads from the switch box to the proper spark plug wires. The primary coil pack pickups are connected to the passenger side coil pack. The secondary coil pack pickups go to the driver side coil pack which is located under the alternator. Clamp the RED TRIGGER pickup around the No.1 spark plug wire of the passenger side coil pack, close to the spark plug.

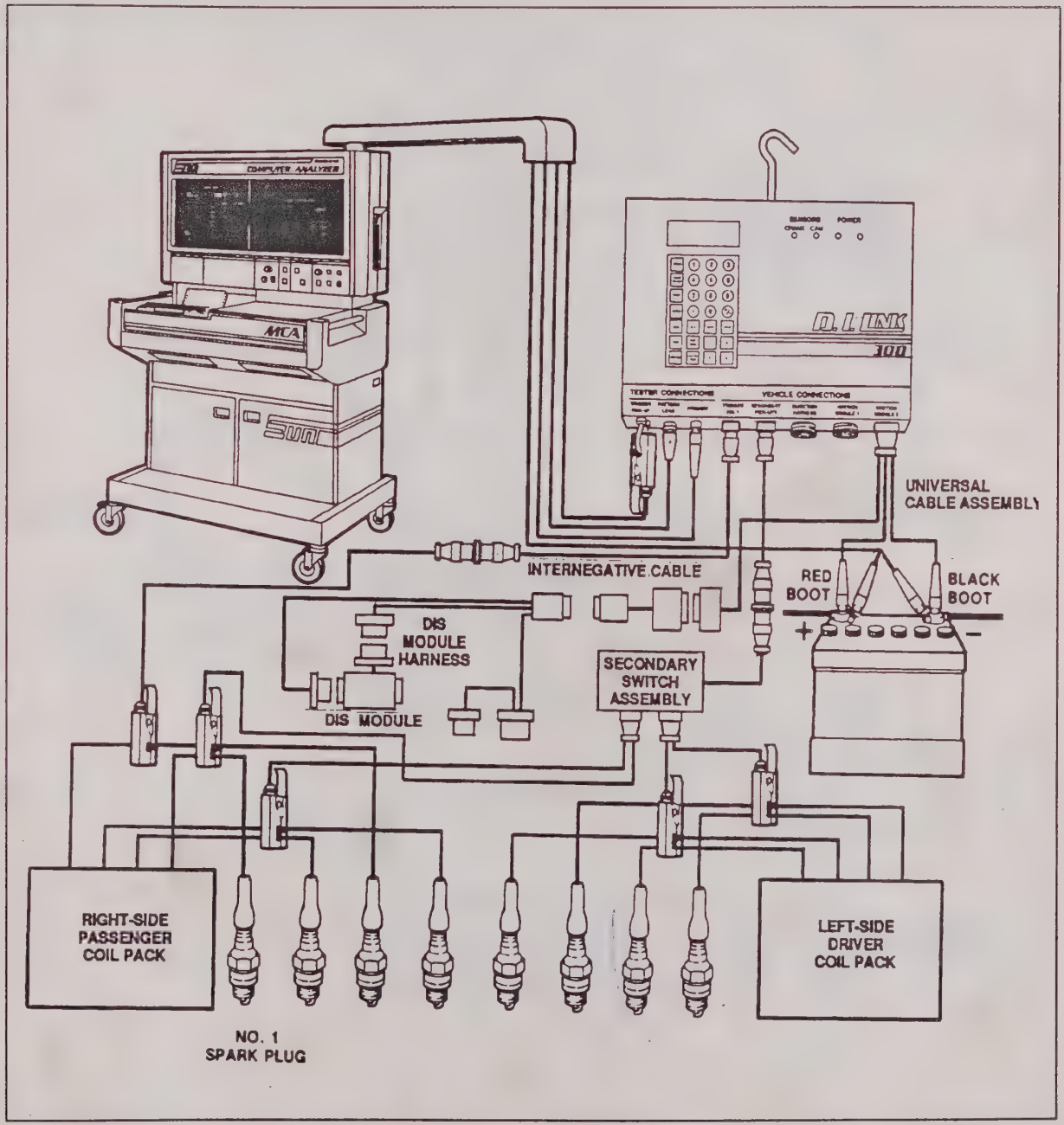
1.9L, 4.0L HDR and 3.0L, 3.8L LDR
Identify positive and negative wires from manufacturer's service manuals.

4.6L HDR
On the 4.6L engine, two secondary pickup assemblies (with two pickups each) are required, because the engine has eight spark plugs. Connect the single end of the "Y" secondary adapter to SECONDARY PICKUPS under VEHICLE CONNECTIONS on the DIL 300. Connect the ends of the two sets of secondary pickups to the two "Y" ends. The four secondary pickups go to the coil pack on top of the engine.

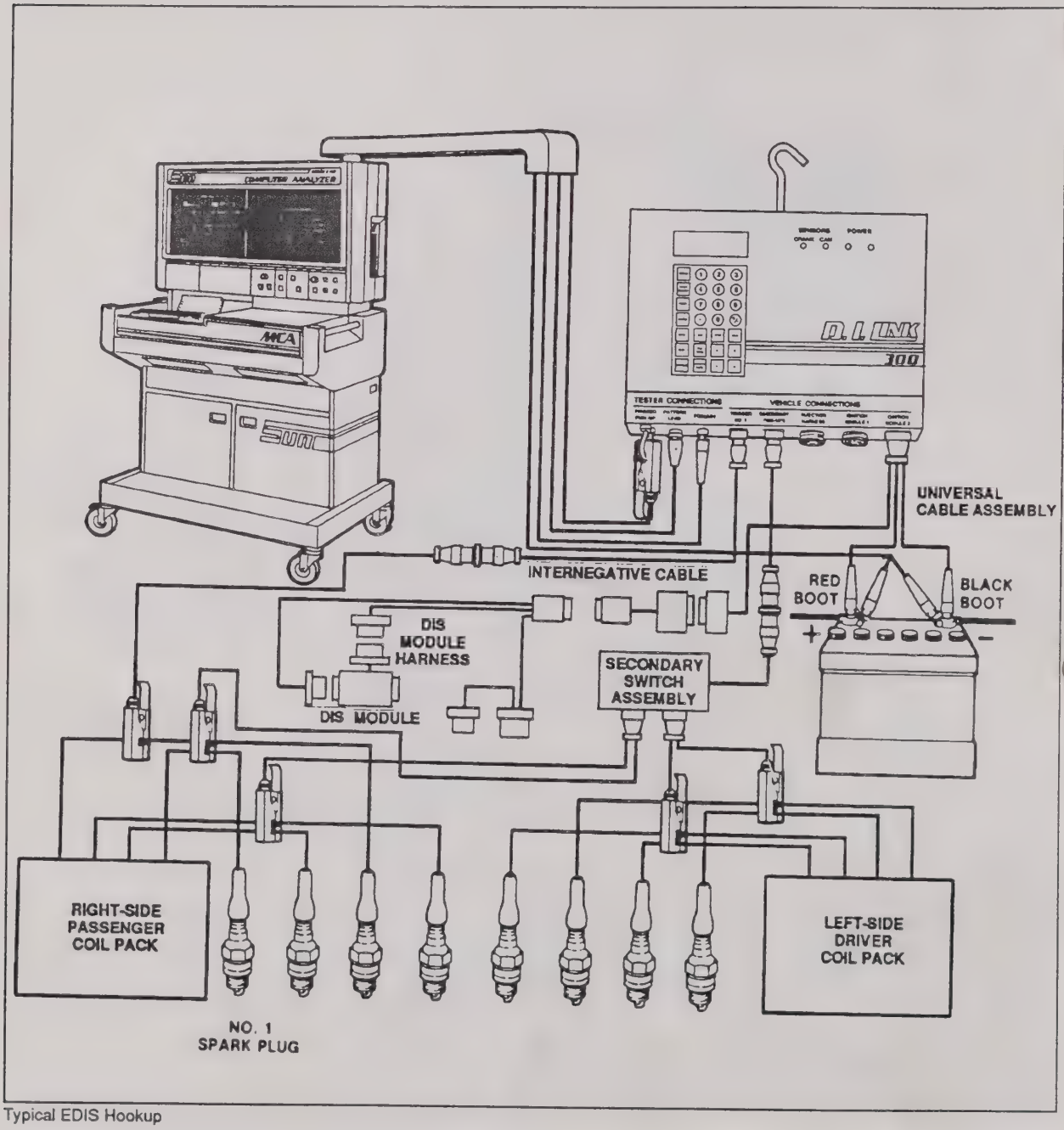
Note **The DIL 300's secondary pickups are spring-loaded; both pickups must be closed tightly around each set of spark plug wires, to insure an accurate sensing of secondary signals. The pickup wires should be parallel, not crossed.**

The plug wires must be connected to the correct polarity (RED-BLACK) pickup. If the correct polarities are not observed, the DIL will not function properly. Refer to the Testing Guidelines section for more information.

If the secondary pickups cannot be clamped around all of the plug wires due to their length or placement on the engine, use the secondary "Y" adapter (PN 6004-0628-1) and a second set of pickups. Disconnect the secondary pickup lead from the DIL and connect the "Y" adapter in its place. This allows you to use two sets of secondary pickups; it is not necessary to use all four pickups. As long as the plug wires are placed in the correct polarity pickup, the DIL will operate correctly.



Typical DIS Hookup



Typical EDIS Hookup

6. Select Host Tester Scope Screens, KV Pages Or Complete Test

Depending on your preferences and analyzer capabilities, choose the desired scope display or digital KV test page on the host tester screen. You can also perform the analyzer's Complete Test, if so equipped.

7. Select KV Display Mode

For KV testing, press the keypad to select either "ADDED", POWER", or "WASTED" mode of KV display. Refer to the Testing Guidelines section for instructions on how to diagnose problems with each display mode.

ADDED: The wasted and combustion (power spark) summed together. Added is the preferred setting for the complete test sequence on all host testers.

WASTED: The secondary KV firing of the cylinders on the exhaust stroke of the engine.

POWER: The secondary KV firing of the cylinder compression or power stroke.

8. Press NORMAL Or POWER BALANCE

If you are peforming power balance tests, press the POWER BALANCE key on the DIL keypad. For all other testing, press NORMAL.

9. Press BASE Or COMPUTED TIMING

BASE TIMING — use only when checking initial ignition timing with a timing light. When selected, the engine is set in base timing mode.

COMPUTED TIMING — for all applications except when using a timing light. The spark circuit operates in the computed timing mode when selected.

10. Check the CAM And Crank LED's

The respective sensor light will blink, indicating that the sensor is sending signals to the electronic control module. Refer to the application chart on page 28. For further information, also refer to distributorless ignition overview.

CAM AND CRANKSHAFT APPLICATION CHART (FORD)

ENGINE	IGNITION TYPE	SENSOR TYPE
1.9	EDIS	CRANK
2.3	DIS	CAM AND CRANK (BOTH SENSORS ARE COMBINED INTO ONE UNIT CALLED A DUAL CRANK SENSOR)
3.0	DIS	CAM AND CRANK
3.8	DIS	CAM AND CRANK
4.0	EDIS	CRANK
4.6	EDIS	CRANK

FORD MODULE HARNESSES

DIS Cable Assembly (E1) 6004 0588 01

EDIS Cable Assembly (F1) 6004 0626 1

Secondary Switch Assembly 7009 2002 01

Pattern Pickup 6004 0544

Secondary "Y" Adapter 6004 0628

CHRYSLER PERSONALITY CARTRIDGE

The Chrysler personality cartridge allows you to perform comprehensive testing on certain Chrysler/Eagle/Mitsubishi vehicles equipped with distributorless ignition systems refered to as Direct Ignition Systems (DIS). Instructions for using the Chrysler Personality Cartridge, Chrysler interface cables, Chrysler applications by system and engine size are detailed in this section. When the technician uses one of these harnesses the CAM and Crank sensor LED's will be active, based on vehicle applications. (Refer to the Quick Reference Guide for harness applications).

Note **Be sure that you have completed the steps in "The Basics -- Getting Starting"before proceeding.**

To Perform Chrysler DIS Vehicle Testing:

1. Insert The Chrysler Personality Cartridge

The Chrysler Personality Cartridge is attached to the RIGHT SIDE of DIL 300 by inserting the cartridge into the receptacle and gently pushing untill it locks in place.When the DIL is powered up, a menu is displayed in the LCD window. Program the DIL 300 for the vehicle being tested by using the keypad to respond to the items displayed in the LCD window.

1. CHRYSLER 3.3L VAN
2. CHRYSLER 3.3L NY
3. MITSU 2.0L 89-90
4. MITSU 1.6L 90-91

2. Select The Application To Be Tested

An application menu is displayed in the LCD window. Identify the exact Chrysler system to be tested. The DIL 300 will automatically display the part number of the module harness required for the vehicle application.

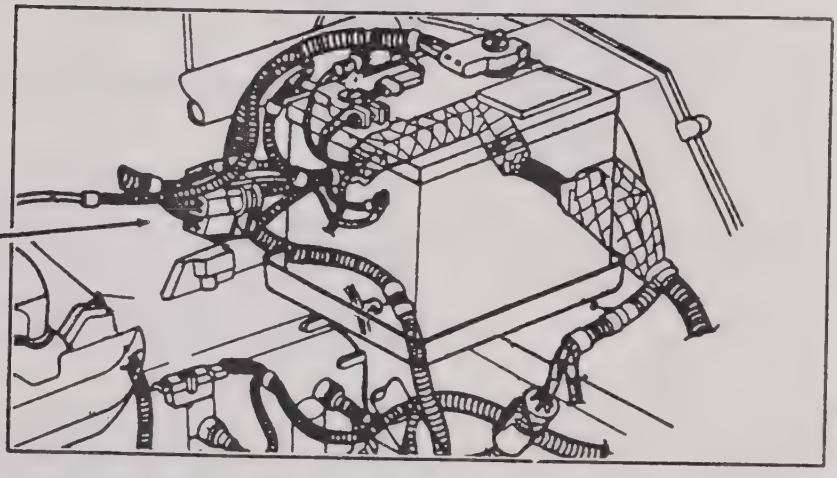
FOR COMPLETE TESTS
USE HARNESS NO:
J

3. Connect The Wire Harness

Depending on the model, one of three wire harnesses is used. The cartridge will prompt you to use the appropriate harness. Refer to the Quick Reference Guide. Each harness has a round connector which is attached to the UNIVERSAL CABLE (U1) connector which attaches to the IGNITION MODULE 2 under VEHICLE CONNECTIONS.

Wire Harness "G": Chrysler 3.3L FWD Minivan (Voyager & Caravan)
To connect wire harness "G", disconnect the 10-pin LIGHT GRAY connector; and the 10-pin DARK GRAY connector. These connectors are located near the battery. Refer to the figure . Plug the complementary colored connectors from wire harness "G" into the vehicle connectors. The wire harness connectors are designed to accept only the correct mates. If necessary, consult manufacturer service manuals.

LIGHT AND DARK GREY CONNECTORS

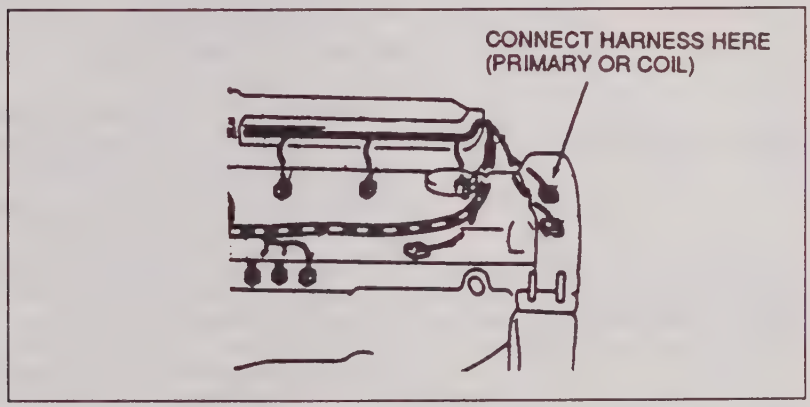


Chrysler 3.3L Connector Lcoation

Wire Harness "H": Chrysler 3.3L FWD New Yorker, Dynasty, Imperial
To connect wire harness "H", disconnect the 10-pin LIGHT GRAY connector; and the 10-pin DARK GRAY connector. These connectors are located near the battery. Refer to Figure 17. Plug the complementary colored connectors from wire harness "H" into the vehicle connectors. The wire harness connectors are designed to accept only the correct mates. If necessary, consult manufacturer service manuals.

Wire Harness "J": Mitsubishi 2.0L Eagle Talon, Plymouth Laser, Mitsubishi Eclipse
To connect wire harness "J", disconnect the two 4-pin CRANK SENSOR connector; and the 4-pin PRIMARY connector. These connectors are located near the firewall on the passenger side of the engine compartment. Refer to the figures. The wire harness connectors are designed to accept only the correct mates. If necessary, consult manufacturer service manuals.

Mitsubishi 2.0L Connector Location (Crank Sensor)



Mitsubishi 2.0L Connector Location (Primary or Coil)

4. Connect The RED Trigger Pickup

When the correct module harness is connected, the DIL will automatically identify the trigger lead cylinder. If the harness is not connected, you will be prompted to identify the trigger cylinder. Attach the trigger lead to the DIL at the connector labeled TRIGGER NO. 1. Clamp the RED trigger pickup around the spark plug wire, which the DIL has identified as the trigger lead cylinder.

5. Connect The Secondary Pickups

Identify the positive and negative wires for the engine to be tested from the Quick Reference Guide. Consult Chrysler service manuals for their locations. When using the cartridge, the help screen will indicate firing order and coil polarity. Attach the pickups on spark plug wires near the coil pack.

THE FIRING ORDER AND
POLARITIES ARE:
1 6 5 4 3 2
+ - + - + -

Note

The DIL 300's secondary pickups are spring-loaded; both pickups must be closed tightly around each set of spark plug wires, to insure an accurate sensing of secondary signals. The pickup wires should be parallel, not crossed.

The plug wires must be connected to the correct polarity (RED-BLACK) pickup. If the correct polarities are not observed, the DIL will not function properly. Refer to the Testing Guidelines section for more information.

6. Select Host Tester Scope Screens, KV Pages Or Complete Test

Depending on your preferences and analyzer capabilities, choose the desired scope display or digital KV test page on the host tester screen. You can also perform the analyzer's Complete Test, if your analyzer is so equipped.

7. Select KV Display Mode

For KV testing, press the keypad to select either "ADDED", POWER", or "WASTED" mode of KV display. Refer to the Testing Guidelines section for instructions on how to diagnose problems with each display mode.

ADDED: The wasted and combustion (power spark) summed together. Added is the preferred setting for the complete test sequence on all host testers.

WASTED: The secondary KV firing of the cylinders on the exhaust stroke of the engine.

POWER: The secondary KV firing of the cylinder compression or power stroke.

8. Press NORMAL Or POWER BALANCE

If you are peforming power balance tests, press the POWER BALANCE key on the DIL keypad. For all other testing, press NORMAL.

9. Check the CAM And Crank LED's

The respective sensor light will blink, indicating that the sensor is sending signals to the electronic control module.
For further information, refer to the distributorless ignition overview.

CHRYSLER WIRE HARNESSES

Wire Harness (H) 6004 0622 1
Wire Harness (G) 7076 0766 02

MITSUBISHI WIRING HARNESS

Wire Harness (J) 6004 0702 01

DISTRIBUTORLESS IGNITION SYSTEMS OVERVIEW

Distributorless ignition systems appeared in the automotive market around 1984 in General Motors vehicles. The application of distributorless ignition systems soon expanded to include Ford, Chrysler, Eagle and Mitsubishi cars. DIS can also be found on import models and is considered the standard for ignition system design for most vehicle applications.

The distributorless ignition system replaces the traditional distributor, distributor cap/rotor and magnetic pick up coil and introduces a cam and crankshaft sensor. Replacement of the H.E.I. conventional ignition system with a distributorless ignition system, also eliminates timing adjustments and allows this function to be controlled by the on-board vehicle computer or ECM. The advantages of using the D.I.S. system compared to conventional electronic ignition systems are:

* Fewer moving engine parts
* Elimination of mechanical timing adjustments
* Less maintenance
* Increased coil saturation time for a hotter spark
* No mechanical load on engine

In general, the term "distributorless ignition" refers to any ignition system that does not incorporate a distributor.

Theory of D.I.S. Operation

In a distributorless ignition system, each ignition coil has two secondary towers, each of which are connected to an individual spark plug. Spark plugs are paired on companion cylinders. Companion cylinders refers to the fact that these cylinders are at the TOP DEAD CENTER position during the four stroke cycle at the same time.

The spark plug firings for the companion cylinders are simultaneous — when the coil discharges both plugs fire at the same time completing the series circuit. One spark plug fires on the compression stroke and is said to be the "EVENT" cylinder, while the other spark plug fires on the exhaust stroke and is said to be the "WASTED" cylinder. With the polarity of the primary and secondary windings being fixed, one plug will fire "Forward" or "Positive". The companion plug will fire "Backwards" or "Negative". The voltage drop across each plug is dependent upon the cylinder pressure and polarity.

For example:
The 2.8L V6 engine has a firing order of 1-2-3-4-5-6 and the cylinder pairs are: 1-4, 2-5 and 3-6. The spark plug polarity for cylinders 2-3-4 is POSITIVE and for cylinders 1-5-6 the polarity is NEGATIVE.

When the engine cranks, a signal will be sent from the crank sensor to signal the ignition module to trigger the second ignition coil in the firing order, thus firing cylinders' #2 and #5 at the same time. When cylinder #2 is on the compression or "combustion" stroke (event firing), cylinder #5 is on the exhaust stroke (wasted firing).

Cylinder #2 will have a greater voltage drop across the spark plug electrode due to the high amount of cylinder pressure during the compression stroke. Cylinder #5 will have a lesser amount of voltage drop due to lack of cylinder pressure during the exhaust stroke.
Due to the series circuitry of distributorless ignition systems, it is not uncommon for one plug to fire normally in the event that its companion plug is defective, misfiring or disconnected. For this reason it is important to understand secondary oscilloscope waveforms and the three modes of display provided by Sun's DIL 300. (Refer to Diagnostic Procedures later in this manual)

Again, the definitions used to describe distributorless ignition systems are:

ADDED: The wasted and combustion (power spark) summed together. Added is the preferred setting for the complete test sequence on all host testers.

WASTED:The secondary KV firing of the cylinders on the exhaust stroke of the engine.

POWER: The secondary KV firing of the cylinder compression or power stroke.

It is also possible for the firing polarity of the sister cylinders of a coil to be reversed. Although this normally will not affect the performance of the vehicle, it will affect the operation of the DIL 300. (Refer to Diagnostic Procedures).

General Motors Systems

General Motors uses three types of Distributorless Ignition systems:

Computer Controlled Coil Ignition (C3I)
Direct Ignition System (D.I.S.)
Integrated Direct Ignition (I.D.I.).

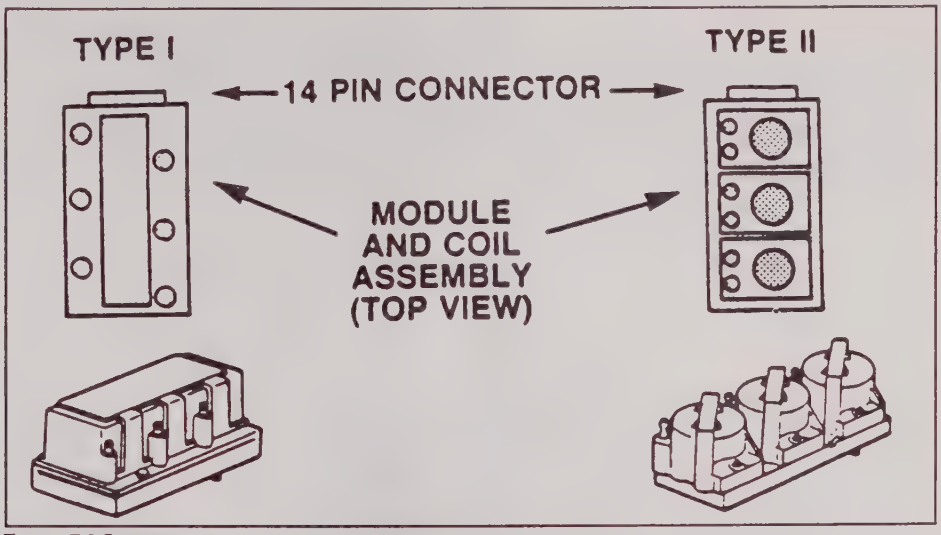
The C3I system was the first distributorless ignition system produced by General Motors in 1984 and was only applicable to the Turbo 3.8L Buick engine for the Riviera and Regal. This system has three types of module variations depending upon model year and body style. It is important in testing these systems that the technician identifies which type of system he/she is working with.

C3I Type I, II, III

The Type I module coil pack has all three coil packs sealed in one unit. The coil towers are opposite one another. This is the easiest way for the technician to identify this system.

Type II has three individual coil packs and the coil towers are all on one side in a straight line. This is the easiest way to identify this system. The coils on this system can be serviced individually.

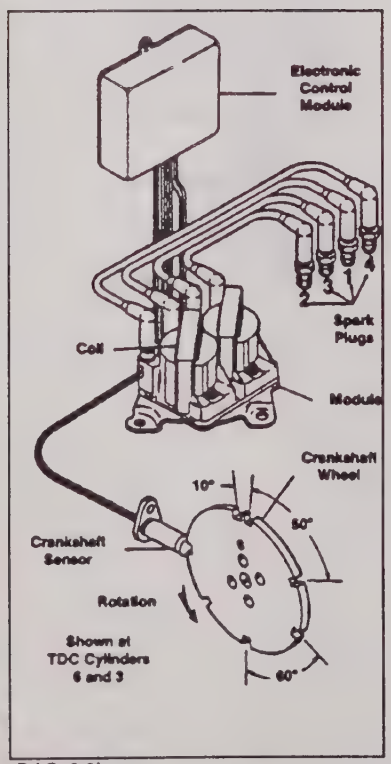
Referred to as "Fast Start" it is similar to Type I in appearance The coil towers are opposite one another but are shorter in height. This system is identified by the smaller coils.



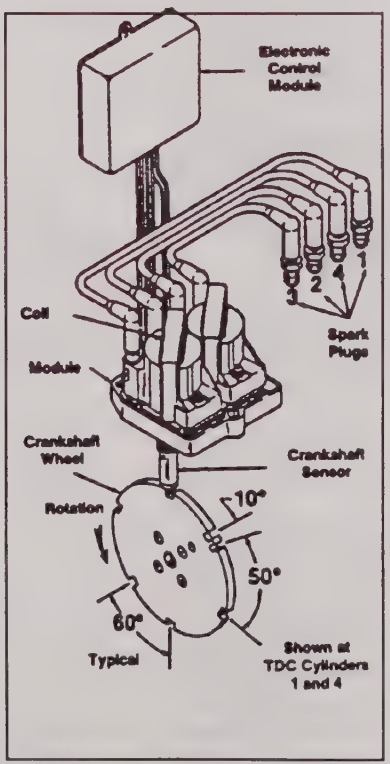
Type 1 7 2 Systems

D.I.S. Direct Ignition System

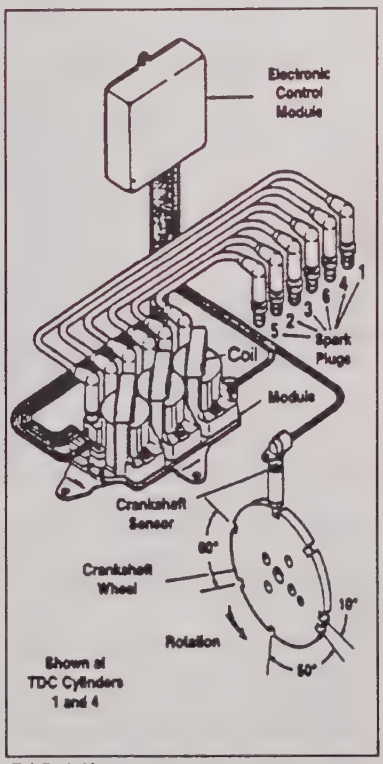
Direct Ignition Systems (D.I.S.) are currently used with Pontiac and Chevrolet engines. The main difference from the C3I system, is the way the crankshaft position is sensed. A Hall Effect switch mounted on the front of the engine has been replaced by a magnetic sensor mounted on the side of the engine block. The D.I.S. system is currently applicable to General Motors 2.0, 2.5 and 2.8 liter engines, 1987 to the present.



D.I.S. 2.0L



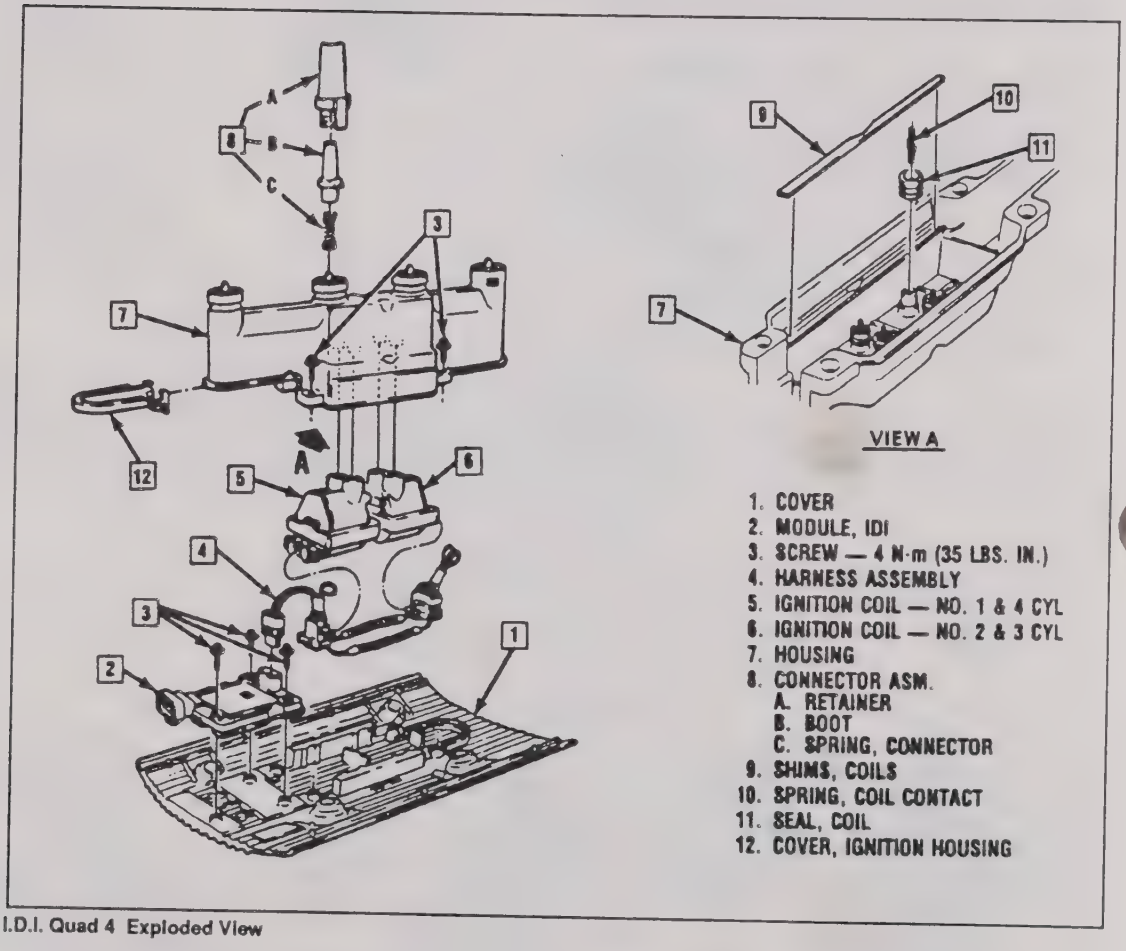
D.I.S. 2.5L



D.I.S. 2.8L

I.D.I. Integrated Direct Ignition

The I.D.I. system is currently applicable to the Quad-4 2.3L engine, 1988 to the present. The I.D.I. system eliminates the secondary spark plug wires by mounting the system right on the spark plugs. This system is similar in operation to the D.I.S. system with several additional advantages.



I.D.I. Quad 4 Exploded View

DISTRIBUTORLESS IGNITION SYSTEMS OVERVIEW

Ford DIS and EDIS

Ford Motor Company currently uses their version of DIS called Distributorless Ignition System (D.I.S.) and Electronic Distributorless Ignition System (E.D.I.S.). While the systems are essentially identical, the EDIS system lacks a cylinder identification sensor (C.I.D.) and features a High Data Rate system that controls coil driver timing offering improved idle quality by updating engine positional reference every 10 degrees of crankshaft rotation.

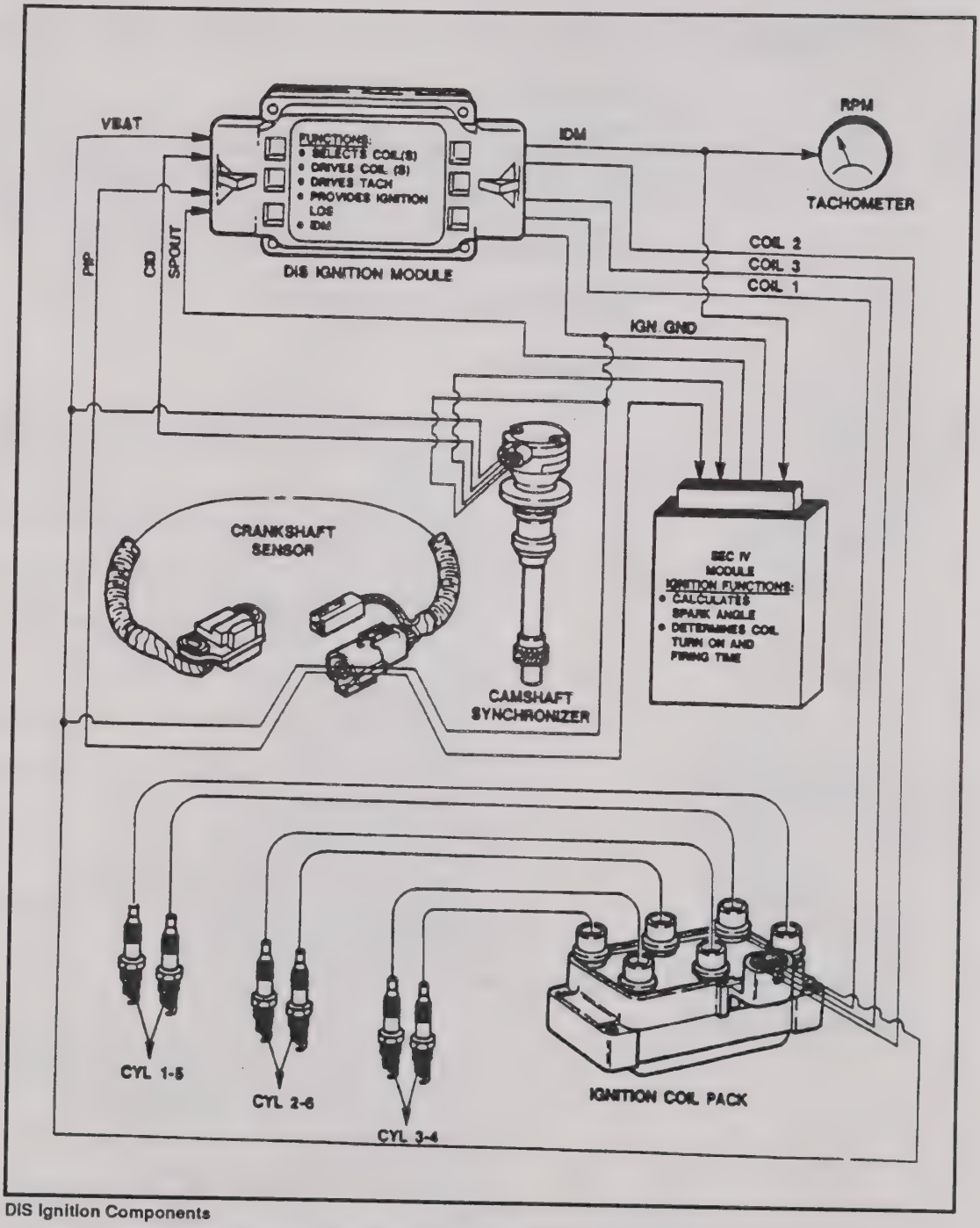
Comparing EDIS and DIS

Similarities

- Elimination of the distributor, distributor cap and rotor.
- Use of coil packs that are similar in design and function for both systems.
- Ignition system separated into two circuits: primary low voltage and secondary highvoltage with multiple coils within the coil packs.
- Two spark plugs wired in series with one coil in the coil pack one plug fires on the compression stroke while the companion plug fires on the exhaust stroke. This process reverses with each crankshaft revolution.
- Base timing for each system is not adjustable and set at 10 degrees BTDC.
- The EEC-IV module determines the spark timing for each system.
- Use of a profile ignition pickup (PIP) signal that is a digital square wave signal with a 50% duty cycle.
- Has provisions for producing a digital ignition diagnostic monitor (IDM) signal that indicates codes for missing or intermittent spark events.
- For certain failure events, a failure mode is activated allowing for limited vehicle operation.

Differences

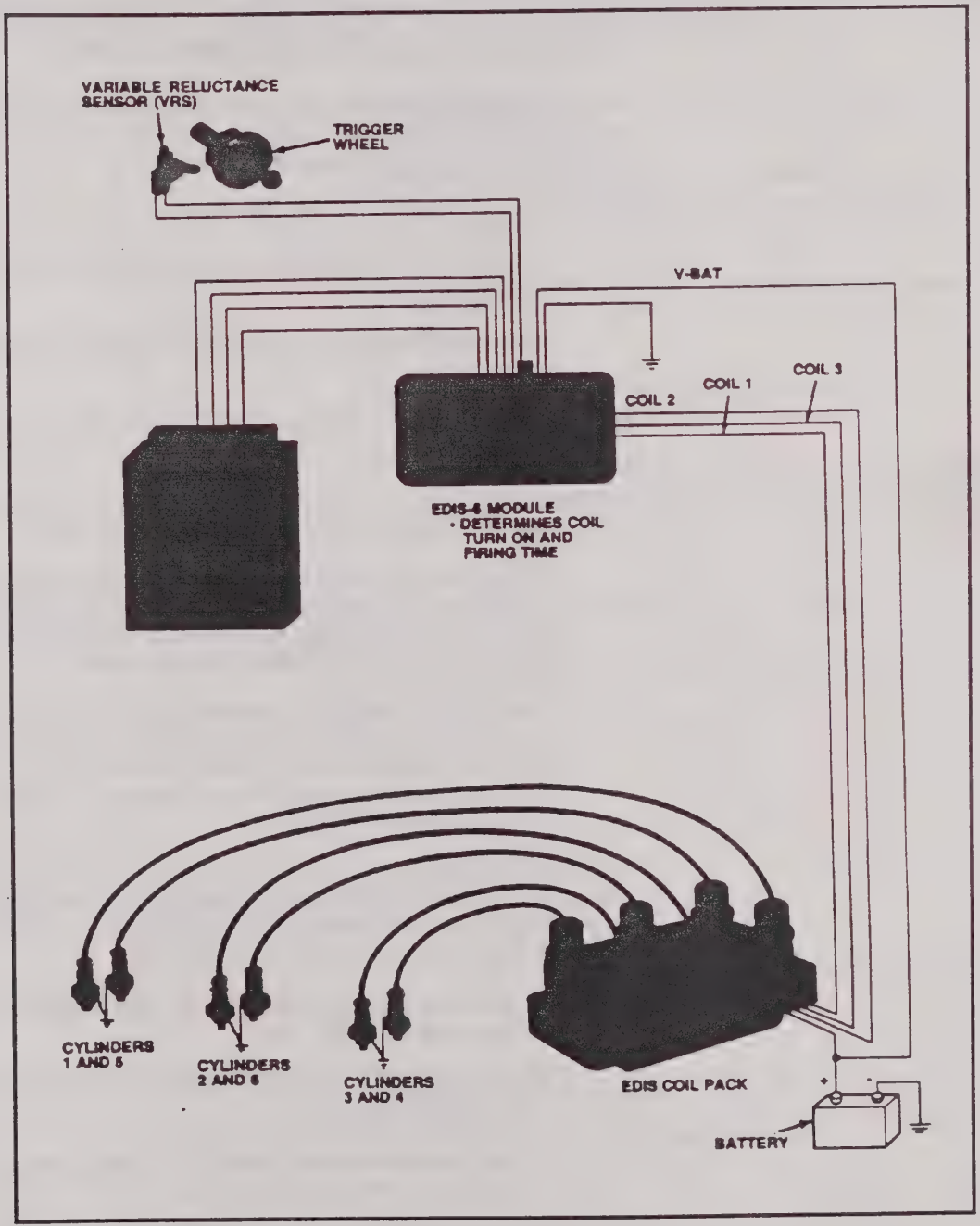
- DIS uses a cylinder identification sensor (CID) and crankshaft position sensor (CP). EDIS uses a variable reluctance sensor (VRS) and a trigger wheel for monitoring piston travel, crankshaft position, and crankshaft speed.
- Crankshaft position signals are more complex and use a higher data rate then the DIS system.
- The CID sensor on EDIS is used for fuel charging controls only.
- PIP signals on EDIS are synthesized from the EDIS module and sent directly to the EEC-IV module.
- PIP signals on EDIS are updated every 10 degrees of crank shaft rotation. Distributorless ignition system PIP signals are updated ever 60 degrees of crankshaft rotation.
- EDIS incorporates a spark angle word (SAW) signal that is more sophisticated and complex than the SPOUT signal used on DIS.



DIS Ignition Components

Ford Distributorless Ignition Applications

D.I.S.	E.D.I.S.
2.3L DP	1.9L SEFI
3.0L SHO	4.0L V-6 Truck
3.8L SC	4.6L V-8



EDIS Ignition Components

Incorrect Cylinder Polarity Symptoms

If the following symptoms are observed during testing, the cylinder polarity may be incorrect or the spark plug wires may be in the incorrect secondary pickup (opposite polarity).

* Engine RPM is erratic or displays zero
* Some or all of the cylinders firing lines are upside down when viewing the pattern
* More than one trace line displayed per cylinder in the scope raster mode
* Dynamic firing KV in the ADDED mode is very low or shows negative KV's

If the DIL has been set up and programmed correctly, cylinder polarity may be reversed, possibly caused by the following conditions:

The positive/negative plug wires on the coil (s) are reversed, causing the cylinder polarity to become reversed. This condition normally will not affect the driveability or performance of the vehicle as it does on normal electronic ignition.

Vehicles with coil/module assemblies have the primary circuit reversed during a coil or module replacement. This condition will not effect the overall performance of the vehicle since this type of system does not have a positive (+) or negative (-) side of the primary windings.

In the event that either of these two symptoms are observed, the operator must identify the correct spark plug polarity. To determine the plug polarity the technician will use the RED BANDED secondary pickup on the DIL 300 and the following procedure:

1. Connect the pattern, red trigger and primary leads of the host tester to the DIL 300.
2. Connect both the host tester and DIL 300 battery leads to the vehicle's battery.
3. Press the power switch on the DIL 300, do not enter any program information in the DIL 300.
4. Connect the single red trigger lead from the DIL 300 to the number one cylinder.
5. Enter the correct vehicle code or set up information into the host tester.

6. Select Dynamic KV or secondary display on the host tester and start the vehicle.

7. Using the RED BANDED secondary clamp attach it to each spark plug wire and record the results for the positive and negative firings using the following guide:

   A. A negative firing spark plug will display readings that are zero or negative in dynamic KV or scope display.

   B. A positive firing spark will display readings that are greater than 2KV in dynamic KV or scope display.

   C. Record the results determined for each plug and connect the corect DIL 300 secondary pickup to the secondary ignition system. (RED-banded: positive, BLACK-banded: negative).

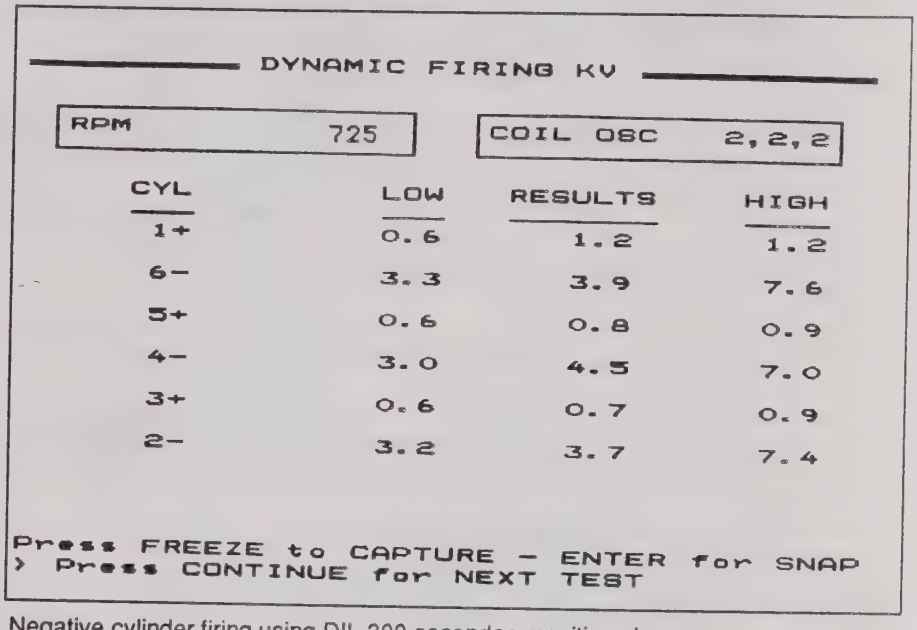
DYNAMIC FIRING KV

RPM	725	COIL OSC	2,3,3

CYL	LOW	RESULTS	HIGH
1+	-1.1	0.3	0.3
6-	-1.1	-1.0	0.4
5+	-1.1	0.4	0.5
4-	-1.1	-1.0	1.5
3+	-1.4	0.4	1.7
2-	-1.1	0.3	0.5

' Press FREEZE to CAPTURE - ENTER for SNAP
> Press CONTINUE for NEXT TEST

Positive cylinder firing using DIL 300 secondary positive clamp



DYNAMIC FIRING KV

RPM 725 COIL OSC 2,2,2

CYL	LOW	RESULTS	HIGH
1+	0.6	1.2	1.2
6-	3.3	3.9	7.6
5+	0.6	0.8	0.9
4-	3.0	4.5	7.0
3+	0.6	0.7	0.9
2-	3.2	3.7	7.4

Press FREEZE to CAPTURE - ENTER for SNAP
> Press CONTINUE for NEXT TEST

Negative cylinder firing using DIL 300 secondary positive clamp

KV Display Modes

The DIL 300 provides the technician with three modes of operation for observing secondary ignition waveforms or dynamic KV's. Each of the display modes, POWER , WASTED, and ADDED, provide advantages in determining faults within the secondary ignition system. It is important that the technician understands the series circuit of distributorless ignition and that two cylinders will fire at the same time, one on the exhaust stroke and one on the power stroke.

Power Mode

When the technician selects this mode, the secondary ignition firings of the power (compression) stroke are displayed. This mode is generally used to determine a high firing (excessive resistance) for a cylinder. Examples of this condition are worn plugs, plug gap set to wide, excessive resistance in a plug wire. Displaying either analog or dynamic KV's will show a high Firing KV for this fault in the secondary ignition. Normal firing KV's are between 8 - 15 KV.

DYNAMIC FIRING KV (Power Mode)

RPM	725		COIL OSC	2, 3, 2
CYL		LOW	RESULTS	HIGH
1+		6.5	10.2	12.8
6-		7.5	10.5	11.1
→ **5+**		**18.6**	**24.2**	**24.4**
4-		6.0	10.5	11.4
3+		7.8	10.1	13.9
2-		8.2	10.2	10.8

3.8L TYPE II GENERAL MOTORS

EXCESSIVE RESISTANCE IN # 5 PLUG WIRE

Wasted Mode

When the technician selects wasted mode ,the secondary ignition firings on the exhaust (wasted) stroke are displayed. In this mode , the opposite cylinder or sister cylinder will display the fault. Normal firing KV's for wasted cylinders are between 2 - 4 KV. For example , cylinder # 2 (the sister cylinder of # 5) will display the high firing voltage. By using the wasted mode the technician can confirm that the fault is in cylinder # 5.

DYNAMIC FIRING KV (Wasted Mode)

RPM	725	COIL OSC	2, 3, 2
CYL	LOW	RESULTS	HIGH
1+	3.3	4.1	4.7
6-	2.8	3.1	3.4
5+	2.7	2.9	3.6
4-	2.5	2.8	3.1
3+	2.4	3.3	3.5
2-	**12.7**	**16.1**	**20.0**

3.8L TYPE II GENERAL MOTORS

EXCESSIVE RESISTANCE IN # 5 PLUG WIRE SHOWS FAULT IN SISTER CYLINDER # 2 OF COIL PACK

Added Mode

When the technician selects ADDED mode, the firing KV's for power (compression) and Wasted (exhaust) are combined for each cylinder. When using this mode, the faults are displayed for both cylinders in the coil pack. In the example of the 3.8L Type II, the second coil pack fires cylinders 5 and 2. Although the fault is in cylinder 5, the sister cylinder no. 2 will also display a high firing KV. This is due to the series circuitry of distributorless ignition. The added mode is the recommended selection for complete testing with your host analyzer. Normal KV firings are between 8 and 15 KV.

DYNAMIC FIRING KV (Added Mode)

RPM	725		COIL OSC	2, 3, 2
CYL		LOW	RESULTS	HIGH
1+		8.1	8.8	11.9
6-		9.8	10.3	12.6
→ **5+**		**15.3**	**8.6**	**24.2**
4-		6.0	10.5	11.4
3+		7.8	10.1	13.9
→ **2-**		**14.9**	**17.4**	**22.7**

3.8L TYPE II GENERAL MOTORS

EXCESSIVE RESISTANCE IN # 5 PLUG WIRE FAULT IS DISPLAYED IN BOTH CYLINDERS OF COIL PACK

Dynamic Spark Duration/Dynamic Spark KV

Selecting dynamic spark duration will also provide the technician with the ability to determine faults in the secondary ignition system based on millisecond firing time of the spark plug. Using the same example as in firing kv, cylinder # 5 shows a short firing time (spark duration), indicating high resistance on cylinder five. The resistance fault can also be seen in the dynamic spark kv. The amount of resistance in the secondary ignition circuit is indicated by the slope of the spark line or the amount of spark kv displayed. The higher the spark kv reading the greater the resistance. Acceptable spark kv readings are approximately 1.5 to 2 KV. Acceptable spark duration is between 1.2 to 2.25 milliseconds. Refer to the manufacturer's specifications for exact readings.

DYNAMIC SPARK DURATION
(Power Mode)

RPM	725		COIL OSC	2, 3, 2	
CYL		LOW	RESULTS	HIGH	
1+		1.64	1.97		2.26
6-		1.56	1.89		2.12
→ **5+**		**0.20**	**0.56**		**0.58**
4-		1.47	1.76		1.97
3+		1.56	1.81		1.99
→ **2-**		**0.48**	**0.53**		**0.59**

3.8L TYPE II GENERAL MOTORS

EXCESSIVE RESISTANCE IN # 5 PLUG WIRE FAULT IS DISPLAYED IN BOTH CYLINDERS OF COIL PACK

DYNAMIC SPARK KV
(Power Mode)

RPM	725		COIL OSC	2, 3, 2
CYL		LOW	RESULTS	HIGH
1+		1.45	1.89	2.10
6-		1.34	2.01	2.23
→ **5+**		**0.65**	**0.89**	**0.98**
4-		1.47	1.99	2.06
3+		1.76	2.21	2.32
→ **2-**		**0.22**	**0.49**	**0.77**

3.8L TYPE II GENERAL MOTORS

 # 5 PLUG WIRE GROUNDED/FOULED
FAULT IS DISPLAYED IN BOTH CYLINDERS
OF COIL PACK

Dynamic KV Compare Mode

When the technician selects KV compare mode, he/she is able to view engine and time requirements of the secondary ignition system.

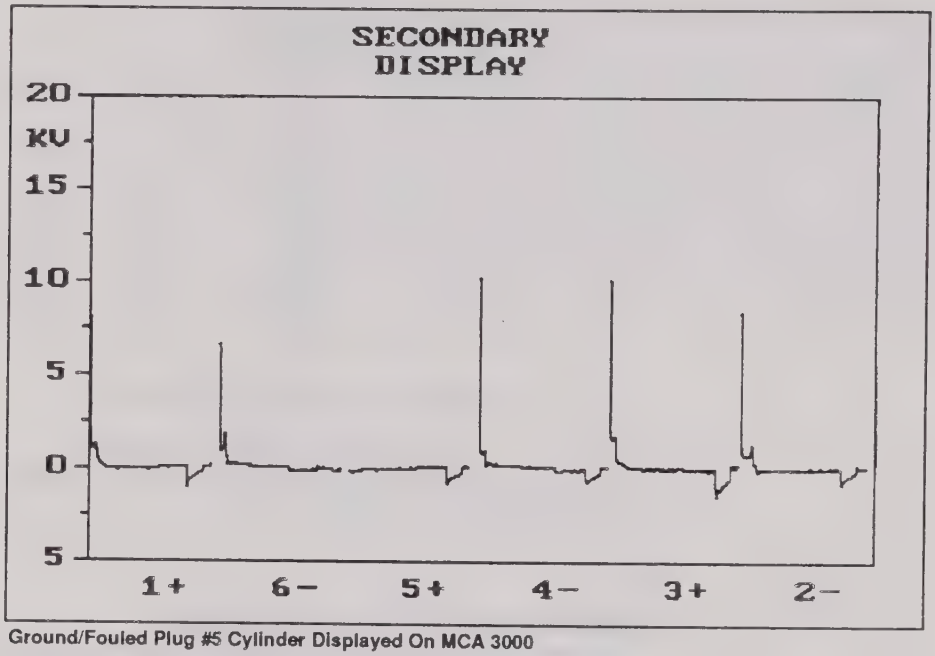
DYNAMIC KV COMPARE
(Power Mode)

RPM	725	COIL OSC	2, 3, 2
CYL	FIRING	SPARK	DURATION
1+	6.5	1.89	1.97
6-	10.5	2.01	1.89
→ 5+	24.5	0.89	0.56
4-	10.5	1.99	1.76
3+	10.1	2.21	1.81
→ **2-**	**10.2**	**0.49**	**0.53**

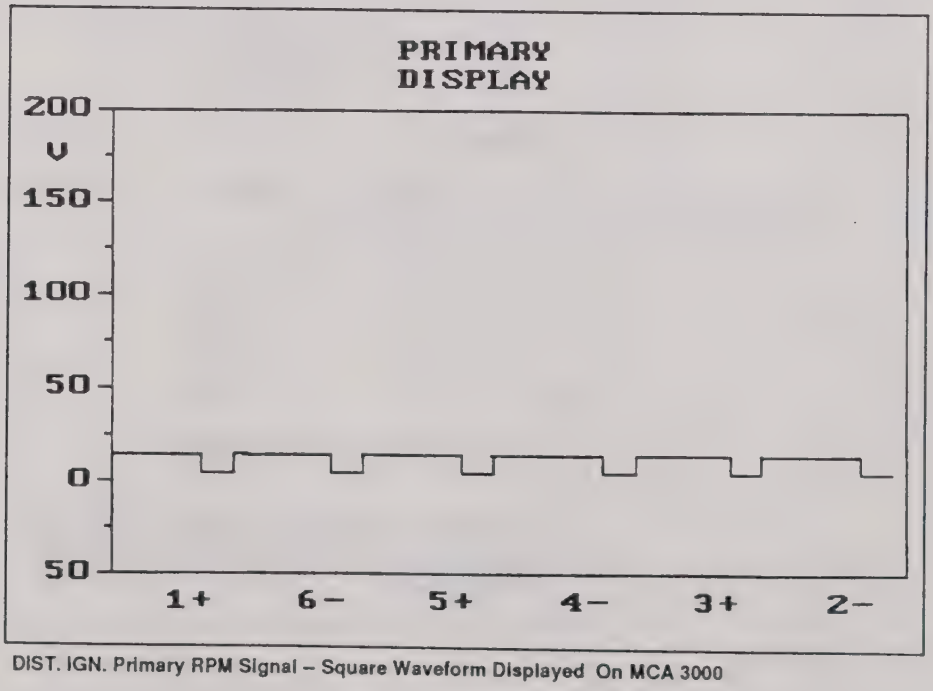
3.8L TYPE II GENERAL MOTORS

EXCESSIVE RESISTANCE IN # 5 PLUG WIRE
FAULT IS DISPLAYED IN BOTH CYLINDERS
OF COIL PACK

Scope Displays



Ground/Fouled Plug #5 Cylinder Displayed On MCA 3000



DIST. IGN. Primary RPM Signal – Square Waveform Displayed On MCA 3000

Coil Oscillations

Conventional electronic ignition systems usually have 3 to 5 oscillations. Distributorless ignition systems generate 2 to 5 oscillations per coil. Coils that continually display less than 2 oscillations may indicate defective primary or secondary windings. If this condition exists it is recommended that the coil windings be checked for proper resistance. Typically ohms readings for primary windings are 0.5 to 0.9 ohms, secondary windings 7 to 12 K ohms. Always refer to the manufacturers' specifications for the exact resistance reading.

Cam and Crankshaft Sensor LED's

The cam and crankshaft sensor LED's on the DIL 300 provide the technician with the ability to determine faults related to no start, intermittent ignition shutdown, spark or fuel delivery. When the LED's for the cam or crank sensor blink steadlily it indicates that the ECM is receiving the sensor signals. No blinking indicates a sensor-related problem within the electronic engine control system that could be a sensor, sensor circuit or wiring fault. It is normal for the LED's to appear as if they are not blinking when the engine is running, due to the speed of these signals.

General Rules

It is important that the technician understands that the same rules for determining ignition faults in conventional electrinic ignition systems still apply to distributorless ignition systems. Firing KV's are still influenced by spark plug gap, spark plug cable design and air/fuel ratio. The technician using the DIL 300 display modes along with the various secondary ignition displays to qualify faults will be able to determine spark plug, spark plug cable and coil pack related problems.

Quick Reference Guide General Motors

DIL-300 Interface Cable and Vehicle Identification Guide

ENGINE SIZE IGN. SYSTEM MODEL YEAR	HARNESS CONNECTIONS	CYLINDER ID (FIRING ORDER) [CYLINDER PAIRS] [FIRING POLARITY]	SECONDARY POLARITY POS.	 NEG.
2.0L D.I.S. 1987	C1 or C to ECM U1	1 2 3 4 (1-3-4-2) [1-4 2-3] [+ - - +]	1-3	2-4
2.0L D.I.S. 1988-1989	B1 or B to ECM U1	1 2 3 4 (1-3-4-2) [1-4 2-3] [+ - - +	1-3	2-4
2.2L D.I.S. 1990-1991	B1 or B to ECM U1	1 2 3 4 (1-3-4-2) [1-4 2-3] [+ - - +]	1-3	2-4
2.3L I.D.I QUAD 4 1988	C1 or C to ECM U1	1 2 3 4 (1-3-4-2) [1-4 3-2] [- + - +]	2-4	1-3
2.3L I.D.I QUAD 4 1989-1992 *1,2	C1 or C to ECM U1	1 2 3 4 (1-3-4-2) [1-4 3-2] [- + - +]	2-4	1-3
2.5L D.I.S. 1987-1992	B1 or B to ECM U1	1 2 3 4 (1-3-4-2) [1-4 2-3] [- + + -]	2-4	1-3
2.5L D.I.S. W BODY 1988-1992	D2 or D1 to ECM U1	1 2 3 4 (1-3-4-2) [1-4 2-3] [- + + -]	2-4	1-3
2.8L D.I.S. W BODY 1988-1989	D2 or D1 to ECM U1	1 3 5 2 4 6 (1-2-3-4-5-6) [1-4 2-5 3-6] [- + + - + -]	2-3-4	1-5-6

Quick Reference Guide General Motors

DIL-300 Interface Cable and Vehicle Identification Guide

ENGINE SIZE IGN. SYSTEM MODEL YEAR	HARNESS CONNECTIONS	CYLINDER ID (FIRING ORDER) [CYLINDER PAIRS] [FIRING POLARITY]	SECONDARY POLARITY POS.	 NEG.
2.8L D.I.S. 1987-1989	C1 or C to ECM U1	1 3 5 2 4 6 (1-2-3-4-5-6) [1-4 2-5 3-6] [- + + - + -]	2-3-4	1-5-6
3.0L C3I Type I 1985-1989	A1 or A to MODULE U1	2 4 6 1 3 5 (1-5-5-4-3-2) [1-4 2-5 3-6] [+ - - + + -]	1-3-5	2-4-6
3.1L D.I.S. W BODY 1989-1992 *3	D2 or D1 to ECM U1	1 3 5 2 4 6 (1-2-3-4-5-6) [1-4 2-5 3-6] [- + + - + -]	2-3-4	1-5-6
3.1L D.I.S. 1989-1992	C1 or C to ECM U1	1 3 5 2 4 6 (1-2-3-4-5-6) [1-4 2-5 3-6] [- + + - + -]	2-3-4	1-5-6
3.3L C3I Type I 1990-1992	A1 or A to MODULE U1	2 4 6 1 3 5 (1-5-5-4-3-2) [1-4 2-5 3-6] [+ - - + + -]	1-3-5	2-4-6
3.4L D.I.S. VIN X 1991-1992	D2 or D1 to ECM U1	1 3 5 2 4 6 (1-2-3-4-5-6) [1-4 2-5 3-6] [- + + - + -]	2-3-4	1-5-6
3.8L C3I Type I 1985-1989	A1 or A to MODULE U1	2 4 6 1 3 5 (1-5-5-4-3-2) [1-4 2-5 3-6] [+ - - + + -]	1-3-5	2-4-6

Quick Reference Guide General Motors

DIL-300 Interface Cable and Vehicle Identification Guide

ENGINE SIZE IGN. SYSTEM MODEL YEAR	HARNESS CONNECTIONS	CYLINDER ID (FIRING ORDER) [CYLINDER PAIRS] [FIRING POLARITY]	SECONDARY POLARITY POS.	 NEG.
3.8L D.I.S Type II 1985-1988	A1 or A to MODULE U1	2 4 6 1 3 5 (1-5-5-4-3-2) [1-4 2-5 3-6] [+ - - + + -]	1-3-5	2-4-
3800 ENG. Type III VIN C 1988-1990 *4	C1 or C to ECM U1	2 4 6 1 3 5 (1-5-5-4-3-2) [1-4 2-5 3-6] [+ - - + + -]	1-3-5	2-4-

Application Notes General Motors;

* 1 excludes 2.3l W body vehicles.

* 2 1992 2.3L Engine kill may not function properly due to a manufacture's computer change. If this situation is experenced the cranking test may still be performed by disabling the fuel system. Disconnect the fuel pump B+ connector, fuse, or relay and start the vehicle and run fuel system dry. Perform the cranking test and enable the fuel system to continue testing.

* 3 1991-1992 3.4L vin X is tested using this menu selection.

* 4 Excludes 3800 engine vin L, 1 TPI.

Quick Reference Guide Ford

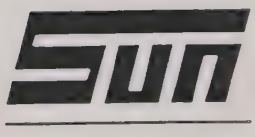
DIL-300 Interface Cable and Vehicle Identification Guide

ENGINE SIZE IGN. SYSTEM MODEL YEAR	HARNESS CONNECTIONS	CYLINDER ID (FIRING ORDER) [CYLINDER PAIRS] [FIRING POLARITY]	SECONDARY POLARITY POS.	 NEG.
1.9L E.D.I.S. 1990-1992 SEFI	F U1	1 2 3 4 (1-3-4-2) [1-4 2-3] [+ - - +]	1-3	2-4
2.3L D.I.S. 1989-1992 DP	E1 or E U1 or U INTER. CABLE 2 SEC. PICK-UPS SEC. SW. ASSY.	1 2 3 4 (1-3-4-2) [1-4 2-3] [+ - - +]	1-3	2-4
3.0L D.I.S. 1989-1991 SHO	E1 or E U1 or U INTER.CABLE	4 5 6 1 2 3 (1-4-2-5-3-6) [1-5 3-4 2-6] [+ - + - + -]	1-2-3	4-5-6
3.8L D.I.S. 1989-1992 S/C	E1 or E U1 or U INTER.CABLE	4 5 6 1 2 3 (1-4-2-5-3-6) [1-5 3-4 2-6] [+ - + - + -]	1-2-3	4-5-6
4.0L E.D.I.S. 1990-1992 V-6 TRUCK	F U1	1 2 3 4 5 6 (1-4-2-5-3-6) [1-5 3-4 2-6] [+ - + - + -]	1-2-3	4-5-6
4.6L E.D.I.S. 1990-1992	F U1 2 SEC. PICK-UPS Y SEC. ADAPTER	1 2 3 4 5 6 7 8 (1-3-7-2-6-5-4-8) [1-6 3-5 7-4 8-2] [- + + - - + + -]	3-4-6-8	1-2-5-7

Quick Reference Guide Chrysler/Eagle/Mitsubishi

DIL-300 Interface Cable and Vehicle Identification Guide

ENGINE SIZE IGN. SYSTEM MODEL YEAR	HARNESS CONNECTIONS	CYLINDER ID (FIRING ORDER) [CYLINDER PAIRS] [FIRING POLARITY]	SECONDARY POLARITY POS.	 NEG.
1.6L 1989-1990 MITSUBISHI	J U1	1 2 3 4 (1-3-4-2) [1-4 2-3] [- + + -]	4-2	1-3
2.0L 1988-1990 MITSUBISHI	J U1	1 2 3 4 (1-3-4-2) [1-4 2-3] [- + + -]	4-2	1-3
3.3L 1990-1992	H U1 or U	1 2 3 4 5 6 (1-2-3-4-5-6) [1-4 3-6 5-2] [+ - + - + -]	1-3-5	2-4-6
3.3L 1990-1992 MINI VAN	G U1	1 2 3 4 5 6 (1-2-3-4-5-6) [1-4 3-6 5-2] [+ - + - + -]	1-3-5	2-4-



SUN ELECTRIC
CORPORATION

ONE SUN PARKWAY
CRYSTAL LAKE, ILLINOIS 60014

0692-1972-01 REV B

©1993 Sun Electric Corporation

Printed in U.S.A

DIL-300 LEAD HOOK-UP CHART

GM

ENGINE/SYSTEM	HARNESS(S) CONNECTIONS (LOCATION)	CYLINDER CONFIGURES. FIRING ORDER FIRING POLARITY CYLINDER PAIRS	SECONDARY HOOK-UP POSITIVE	NEGATIVE
2.0L 1987	C1 OR C U1 (ECM)	C.C.: 1 2 3 4 F.O.: 1 3 4 2 F.P.: + + - - C.P.: 1-4 3-2	1-3	2-4
2.0L 1988-1989	B1 OR B U1 (ECM)	C.C.: 1 2 3 4 F.O.: 1 3 4 2 F.P.: + + - - C.P.: 1-4 3-2	1-3	2-4
2.2L 1990	B1 OR B U1 (ECM)	C.C.: 1 2 3 4 F.O.: 1 3 4 2 F.P.: + + - - C.P.: 1-4 3-2	1-3	2-4
2.3L(QUAD 4) 1988	C1 OR C U1 (ECM)	C.C.: 1 2 3 4 F.O.: 1 3 4 2 F.P.: - - + + C.P.: 1-4 3-2	2-4	1-3
2.3L(QUAD 4) 1989-1990	C1 OR C U1 (ECM)	C.C.: 1 2 3 4 F.O.: 1 3 4 2 F.P.: - - + + C.P.: 1-4 3-2	2-4	1-3
2.5L(W BODY) 1990	D2 OR D1 U1 (ECM)	C.C.: 1 2 3 4 F.O.: 1 3 4 2 F.P.: - - + + C.P.: 1-4 3-2	2-4	1-3
2.5L 1987-1990	B1 OR B U1 (ECM)	C.C.: 1 2 3 4 F.O.: 1 3 4 2. F.P.: - - + + C.P.:	2-4 1-4 3-2	1-3
2.8L(W BODY) 1988	D2 OR D1 U1 (ECM)	C.C.: 1 3 5 2 4 6 F.O.: 1 2 3 4 5 6 F.P.: - + + + - - C.P.: 1-4 2-5 3-6	2-3-4	1-5-6

CHRYSLER/EAGLE/MITSUBISHI

ENGINE/SYSTEM	HARNESS(S) CONNECTIONS	FIRING ORDER FIRING POLARITY CYLINDER PAIRS	SECONDARY HOOK-UP POSITIVE	NEGATIVE
3.3L (MINIVAN) 1990-1991	G U1	F.O.: 1 2 3 4 5 6 F.P.: + - + - + - C.P.: 1-4 3-6 5-2	1-3-5	2-4-6
3.3L (NEW YORKER) 1990-1991	H U1	F.O.: 1 2 3 4 5 6 F.P.: + - + - + - C.P.: 1-4 3-6 5-2	1-3-5	2-4-6
2.0L (MITSU.) 1988-1990	J U1	F.O.: 1 3 4 2 F.P.: - - + + C.P.: 1-4 2-3	4-2	1-3
1.6L (MITSU.) 1990-1991	U1	F.O.: 1 3 4 2 F.P.: - - + + C.P.: 1-4 2-3	4-2	1-3

*NOT ABLE TO INTERFACE WITH AT THE PRESENT TIME.

SUN ELECTRIC CORPORATION
One Sun Parkway
Crystal Lake, Illinois 60014

692-1971-01 REV A

© 1991 Sun Electric Corporation

Printed in U.S.A.

SUN ELECTRIC CORPORATION

Model: Kit #0120-0495

Assembly & Installation Instructions

The installation of Kit #0120-0495 provides the MEA-1500 with the Amps/Vacuum Option and is only available as a Field Installation item.

PARTS LIST

QTY	PART NUMBER	DESCRIPTION
1	7001-0605	Amps/Vacuum, C.C.A.
5	0403-1341-06	Screws, 6-32 by 3/8" Hex
1	7076-0514	Wiring Harness, Amps/Vacuum, W10
1	7076-0515	Wiring Harness, Amps/Power, W15
1	7076-0516	Wiring Harness, Amps Input, W20
40"	0669-0229	Hose, Vacuum 3/16" I.D.
1	2209-0002	Nipple, Hose
2	0409-0029	Nut, Hex 3/8"
2	0603-0010	Washer, Lock, Ext. 3/8"
8	5878-0015	Wire Ties
1	6006-0007	Hose Assembly, Vacuum
1	6005-0133-01	Test Lead Assembly, Current
1	2894-0501	Tee Assembly, Hose
1	0669-0623	Hose Rubber, 6"
1	0669-0733	Hose Rubber, 6"
1	0669-0734	Hose Rubber, 6"
2	0400-0025	Washer, Fiber
1	1243-0800-04	Identification Plate

REQUIRED TOOLS

FLAT SCREWDRIVER
1/4" SOCKET SET
PHILLIPS SCREWDRIVER
NUT DRIVER SET

INSTALLATION PROCEDURE

1. Turn the tester power "OFF" and unplug from the A.C. outlet.
2. Remove the two front panel screws holding the C.C.A. "drawer" in place and pull out the drawer.
3. Remove the rear panel by removing all the test leads from the input board on the rear of the tester and remove the nine screws securing the rear panel.
4. Remove the two screws holding the Power Supply "drawer" (located in the lower right hand side of the tester as viewed from the rear) in place and pull it open.

Printed in U.S.A.

0692-1413-01(7820)

5. As you are facing the front of the tester, mount the Amps/Vac board (p/n 7001-0605) to the right hand side of the Volt/Ohm/Mag board (p/n 7001-0606), with the Cal Pots to the front, and secure into place using the provided hardware. **CAUTION: Place one of the Fiber Washers provided, on both sides of the C.C.A.'s center mounting hole. Failure to do so could result in shorting of the Board to chassis GRD.**

6. Remove the wiring harness marked P301 on one end of the harness (W10) from the parts package and connect P301 to J301 on the Amps/Vac Board and P110 to J110 on the Digital Electronics Board.

7. Remove the wiring harness marked P303 on one end of the harness (W15) from the parts package and connect P303 to J303 on the Amps/Vac Board. Route W15 to the rear of the C.C.A. drawer and down to the Power Supply Shelf and connect P603 to J603 on the Power Supply Assy.

8. Remove the wiring harness marked P302 on one end of the harness (W20) from the parts package and connect P302 to J302 on the Amps/Vac Board. Route W20 up to the Input Board and connect P402 to J402 on the Input Board.

9. Remove the black plug, located on the Input Board mounting bracket. Place one of the 3/8" lock washers and one of the 3/8" hex nuts supplied, over the nipple and insert the larger end of the nipple through the hole from the inside. Install and tighten the 3/8" washer and hex nut supplied.

10. Connect the supplied clear Vacuum Hose (p/n 0669-0229) to the vacuum transducer on the board and route it through the tester along the digital side of the tester and up to the Input Board at the rear of the tester. DO NOT cut the hose to length. Connect the hose over the vacuum nipple.

11. Position the vacuum hose and wiring/ribbon harnesses to the rear of the main C.C.A. drawer and then to the out sides of the tester allowing enough slack so the drawers open and close with no binding or pulling and secure them with cable straps and ties provided.

12. Turn switch number 5 of SW1 located on the Digital Electronics Board (p/n 7001-0604) to the "ON" position to activate the Amps/Vac option.

13. Push in both drawers and re-install the hold down screws. Then re-install the rear panel and hook up the leads.

14. Remove the Vacuum Hose Assembly (p/n 6006-0007) and the Current Tester Lead Assembly (p/n 6005-0133-01) from the parts package and install them on the tester.

15. Affix the provided Option Kit Identification Plate to the MEA-1500 next to its Serial Plate or any other Option Kit I.D. Plate already present at that location. **NOTE:** Make sure the surface is clean and free of dirt!

CHECKOUT PROCEDURE

Refer to Chapter 8 of the MEA-1500 Service Manual for the complete checkout and calibration procedure.

****
* INSTALLATION COMPLETE *
****

(U.S. Orders & Customers Only)

ORDERING INFORMATION

- Test Link Software
- Technical Publications
- Merchandising Kit

SUN ELECTRIC CORPORATION

502-1932 REV A

In Canada, contact Sun Automotive Canada Ltd. (416) 625-6266 For orders outside the U.S., contact Sun Electric's Export Division or your local Sun representative

TEST LINK SOFTWARE

SOFTWARE	PRICE	MCA/MGA/ MTT	QTY.	1805Z	QTY.	MEA	QTY.	TOTAL
GM 1981 CCC	$120.00	7009-1973B19		7009-1975B19		7009-1974B19		$
GM 1982 CCC	120.00	7009-1973B10		7009-1975B10		7009-1974B10		
GM 1983 CCC	120.00	7009-1973B12		7009-1975B12		7009-1974B12		
GM 1984 CCC	120.00	7009-1973C15		7009-1975C15		7009-1974C15		
GM 1985 CCC	120.00	7009-1973A16		7009-1975A16				
GM 1986 CCC	120.00	7009-1973B33		7009-1975B33				
GM 1987 CCC	120.00	7009-1973A50		7009-1975A50				
GM 1988 CCC	120.00	7009-1973A67		7009-1975A67				
GM 1989 CCC	120.00	7009-1973AA1		7009-1975AA1		7009-1974AA1		
GM 1990 CCC	120.00	7009-1973AB6		7009-1975AB6		7009-1974AB6		
GM 1982 TBI	120.00	7009-1973B11		7009-1975B11				
GM 1983 TBI	120.00	7009-1973C13		7009-1975C13				
GM 1984 TBI	120.00	7009-1973A20		7009-1975A20				
GM 1985 TBI	120.00	7009-1973B21		7009-1975B21				
GM 1986 TBI	120.00	7009-1973C35		7009-1975C35		7009-1974C35		
GM 1987 TBI	120.00	7009-1973A49		7009-1975A49				
GM 1988 TBI	120.00	7009-1973B66		7009-1975B66				
GM 1989 TBI	120.00	7009-1973AA0		7009-1975AA0		7009-1974AA0		
GM 1984 PFI	120.00	7009-1973A28		7009-1975A28				
GM 1985 PFI	120.00	7009-1973B27		7009-1975B27		7009-1974B27		
GM 1986 PFI	120.00	7009-1973B26		7009-1975A26				
GM 1987 PFI (2)	120.00	7009-1973A47		7009-1975A47				
GM 1988 PFI (3)	120.00	7009-1973B64		7009-1975B64		7009-1974B64		
Gm 1989 PFI (3)	120.00	7009-1973A97		7009-1975A97		7009-1974A97		
GM 87 LIGHT TRUCK	120.00	7009-1973A78		7009-1975A78				
GM MON. 80-87	70.00	7009-1973D30		7009-1975D30				
GM MON. 88-90 (2)	70.00*	7009-1973C93		7009-1975C93				
GM MON. 80-91	70.00					7009-1974C93		
GM MON. 91-92	70.00	7009-1973AB9		7009-1975AB9		7009-1974AC2		
GM ABS/SIR 91-92	120.00	7009-1973AC8		7009-1975AC8		7009-1974AC8		
CHRY 84 2.2 EFI	120.00	7009-1973B18		7009-1975B18				
CHRY 85 2.2 EFI	120.00	7009-1973B17		7009-1975B17				
CHRY 86 2.2 EFI	120.00	7009-1973B36		7009-1975B36				
CHRY 87 2.2 EFI	120.00	7009-1973B37		7009-1975B37				
CHRY 87.5-88 EFI (2)	120.00	7009-1973A63		7009-1975A63		7009-1974A63		
CHRY 85 CARB.	120.00	7009-1973A38		7009-1975A38		7009-1974A38		
CHRY 86 CARB	120.00	7009-1973A40		7009-1975A40		7009-1974A40		
CHRY 87 CARB.	120.00	7009-1973A41		7009-1975A41		7009-1974A41		
CHRY 88 CARB.	120.00	7009-1973A62		7009-1975A62		7009-1974A62		
CHRY MONITOR 89-91	70.00	7009-1973AA8		7009-1975AA8		7009-1974AA8		
CHRY MONITOR 84-88	70.00	7009-1973C59		7009-1975B59		7009-1974A59		

SUBTOTAL	
UPS/HANDLING	$2.00/disk
YOUR STATE & LOCAL SALES TAX	
TOTAL	

TECHNICAL MANUALS

TITLE	PRICE	PART #	QTY.	TOTAL
Electronic Ignition Diagnosis	$ 27.00	2500-296		
Automotive Emission Control	17.00	2500-297		
Electronic Fuel Injection	29.00	2500-298		
Computerized Engine Controls '83	30.00	2500-299		
Computerized Engine Controls '82	18.00	2500-300		
Computerized Engine Controls '80 - '90	25.00	2500-301		
Automotive Air Conditioning	22.75	2500-302		
Wheel Alignment Specifications	24.00	2500-303		
Ford DIS Student Handbook	12.00	2500-306		
Ford EFI Student Handbook	12.00	2500-307		
Ford EEC System Strategies	19.50	2500-308		
Import Fuel Injection	26.00	2500-310		
Chrysler O2 Feedback Systems	5.90	2500-311		
Chrysler Driveability Procedures	7.80	2500-312		
Chrysler EFI/MPFI Systems	7.80	2500-313		
Chrysler SMEC Systems	7.80	2500-314		
Chrysler Spark Control Systems	8.50	2500-315		
Automotive Electricity/Electronics	24.00	2500-316		
Ford MCU/EEC Driveability	32.00	2500-317		
EEC System Operations	8.00	2500-318		
Automotive Testing And Diagnosis	10.00	692-0931		
Understanding Oscilloscope Patterns	15.00	2500-254		
Understanding Signal Waveforms	19.95	692-2032		
Automotive Service Marketing	25.00	ASM BOOK		

SUBTOTAL	
UPS HANDLING	$2.50/book
STATE & LOCAL SALES TAX	
TOTAL	

Mail Order to:Sales Wholesale Division
Sun Electric Corporation
One Sun Parkway
Crystal Lake, IL 60014

Delivery: Allow at least (14) days for in-stock items.

Questions: Please contact 1-800-CALL-SUN

SOLD TO:

Name

Company

Address

City/State/Zip

( )
Phone

SHIP TO: Please, no P.O. boxes

Name

Company

Address

City/State/Zip

( )
Phone

METHOD OF PAYMENT:

☐ VISA ☐ Mastercard

☐ Money Order ☐ Personal Check

Card Number

Exp. Date
Month Year

Signature

$
Total Amount

TEST LINK SOFTWARE

SOFTWARE	PRICE	MCA/MGA/ MTT	QTY.	1805Z	QTY.	MEA	QTY.	TOTAL
CHRY MONITOR	70.00	7009-1973C59		7009-1975B59		7009-1974A59		
NISSAN 85 ECCS	120.00	7009-1973A25		7009-1975A25		7009-1974A25		
HONDA 86	120.00	7009-1973A54		7009-1975A54		7009-1974A54		
MAZDA 86-87 323	120.00	7009-1973A42		7009-1975A42		7009-1974A42		
MAZDA 86-87 RX7	120.00	7009-1973B51		7009-1975B51		7009-1974B51		
MAZDA 86-87 626	120.00	7009-1973B52		7009-1975B52		7009-1974B52		
MAZDA 88-90 626/MX6	120.00	7009-1973A69		7009-1975A69		7009-1974A69		
MAZDA 88-90 323	120.00	7009-1973A70				7009-1974A70		
MAZDA 88-90 929/929S	120.00	7009-1973A71		7009-1975A71		7009-1974A71		
TOYOTA 83-87	120.00	7009-1973A56		7009-1975A56		7009-1974A56		
ACURA 86-87	120.00	7009-1973A61		7009-1975A61				
FORD MONITOR 89-91	70.00	7009-1973CA9		7009-1975CA9		7009-1974CA9		
FORD MONITOR 83-88	70.00	7009-1973B58		7009-1975B58		7009-1974B58		
FORD 1989 EEC IV	110.00	7009-1973B95		7009-1975B95		7009-1974B95		
FORD ABS	70.00	7009-1973B43		7009-1975A43		7009-1974A43		
LIMITS + DIAG. 92	299.00	7009-1973C05		7009-1973AB5		**		
MCA Operating System *	15.00	7009-1973AB8		—		—		
MS-DOS 3.3	95.00	0552-0050						

SUBTOTAL	
UPS/HANDLING	$2.00/disk
STATE & LOCAL SALE TAX	
TOTAL	

NOTE: $20.00 Charge to replace damaged disk; return old disk for program re-copying

** Contact your Sun Customer Service Representative for details

( ) System descriptions with parenthesis next to them indicate number of disks in program pack (Example: GM 1987 PFI (2) - the number "2" in parenthesis indicates a two disk package.)

* This is a two-disk set containing a new, updated 88-90 GM monitor disk which is packaged at no charge when the customer orders the 88-91 monitor disk. The price is $70 for the whole kit

MERCHANDISING KIT/BANNERS

DESCRIPTION	PRICE		QTY.		TOTAL
Complete Kit (incl.)	$ 75.63				
Diagnostic Banner	6.85				
Pole Sign	21.40				
Diagnostic Sign	3.79				
String Pennants (2)	12.58				
3X5 Decals	.31				
Check Up Decals	.04				
Counter Cards w/Pocket	17.96				
Open/Closed Door Signs	7.21				
Counter Mat	14.32				
Computer Diagnosis Banner (3 x 8)	15.00				
Emission Testing Banner (3 x 8)	15.00				
Air Conditioning Service Banner	15.00				

SUBTOTAL	
UPS/HANDLING	$3.50/it
STATE & LOCAL SALE TAX	
TOTAL	

Scott Specialty Gases, Inc.
ROUTE 611 NORTH, PLUMSTEADVILLE, PA 18949 (215) 766-8861

REGIONAL PHONE NUMBERS

PA (215) 766-8861 **CA** (714) 887-2571 **MI** (313) 589-2950

SECTION I - MATERIAL IDENTIFICATION

CHEMICAL NAME: Carbon Monoxide
Carbon dioxide and
Propane in Nitrogen

SUPPLIER: Scott Specialty Gases

CHEMICAL FORMULA: CO, CO_2, C_3H_8/N_2

ADDRESS: Route 611, Plumsteadville, Pa 18949

CHEMICAL FAMILY: Acid gas,
Hydrocarbon gas mixture

IN CASE OF EMERGENCY, CONTACT YOUR REGIONAL PLANT MANAGER

DATE PREPARED: 8/19/87

OTHER DESIGNATIONS: Inspection/Maintenance Calibration Gas

SECTION II - HAZARDOUS INGREDIENTS

			EXPOSURE LIMITS (PPM) ACGIH	OSHA
COMPONENT	**CAS NO**	**CONCENTRATION**	**TLV**	**PEL**
Carbon Monoxide	630-08-0	1.2% - 8.0%	50	50 ppm TWA
Carbon Dioxide	124-38-9	4.0 - 16.0%	5000	5000 ppm TWA
Propane	74-98-6	600 -3200 ppm	None	1000 ppm TWA
Nitrogen	7727-37-9	Balance	None	None

SECTION III - PHYSICAL DATA

BOILING POINT: N/A

SPECIFIC GRAVITY (H_2O = 1): @ 20°c N/A

VAPOR PRESSURE @ 20°C: N/A

PERCENT, VOLATILE BY VOLUME (%): N/A

VAPOR DENSITY (AIR = 1): 1.0139

EVAPORATION RATE (_____=1): N/A

SOLUBILITY IN WATER: N/A

APPEARANCE AND ODOR: Colorless, odorless to sweet odor due to propane

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT AND METHOD	**FLAMMABLE LIMITS**	**LEL**	**UEL**
N/A	N/A		

EXTINGUISHING MEDIA: Use what is appropriate for surrounding fire

DISCLAIMER The information in this Material Safety Data Sheet is offered without charge for use by technically qualified personnel at their discretion and risk. Scott Specialty Gases has made this sheet available with data which we believe is reliable, but the accuracy and completeness of the data is not guaranteed and no warranty is either expressed or implied. Since Scott Specialty Gases has no control over the use of this product described herein, we assume no liability for loss or damage incurred from the proper or improper use of such product. This form is essentially similar to U.S. Department of Labor form OSHA-20.

SPECIAL FIRE FIGHTING PROCEDURES: Keep fire-exposed cylinders cool with water spray.

UNUSUAL FIRE AND EXPLOSION HAZARDS: N/A

SECTION V - REACTIVITY DATA

STABILITY: All components are stable

INCOMPATIBILITY (MATERIALS TO AVOID): Propane reacts with oxidizing agents. Carbon dioxide, being weakly acidic, reacts with alkaline materials to form carbonates and bicarbonates. Nitrogen reacts with Li, Nd, and Ti at high temperatures.

HAZARDOUS DECOMPOSITION PRODUCTS: None

HAZARDOUS POLYMERIZATION: Will not occur

SECTION VI - HEALTH HAZARD DATA

ROUTES OF ENTRY: Inhalation

EFFECTS OF OVER EXPOSURE **(ACUTE)**: Mixture may act as an asphyxiant by displacing oxygen. Symptoms would include rapid respiration, mental dullness, fatigue, nausea, and vomiting. Carbon monoxide is highly toxic and can cause shortness of breath, headache, confusion, nausea, dizziness, unconsciousness, and may be fatal. Carbon dioxide at high concentrations will produce labored breathing, possible unconsciousness, and is dangerous to life.

CARCINOGENICITY NTP? NO IARC MONOGRAPHS? NO OSHA REGULATED NO

EMERGENCY AND FIRST AID: Remove victim to fresh air. Give oxygen and/or artificial respiration as necessary. Get immediate medical attention for serious exposure.

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN: Ventilate area. Remove leaking cylinder to exhaust hood or safe out of doors area. Eliminate sources of ignition.

WASTE DISPOSAL METHOD: Allow gas to discharge at a slow rate. Waste gas can be piped to an approved incinerator to burn off propane and convert CO to CO_2 under controlled conditions. Return defective cylinder to supplier.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE): Use a self-contained breathing apparatus in case emergency or non-routine use.

VENTILATION: Provide adequate general and local exhaust ventilation to meet TLV requirements.

OTHER PROTECTIVE EQUIPMENT: Safety shoes are recommended when handling cylinders.

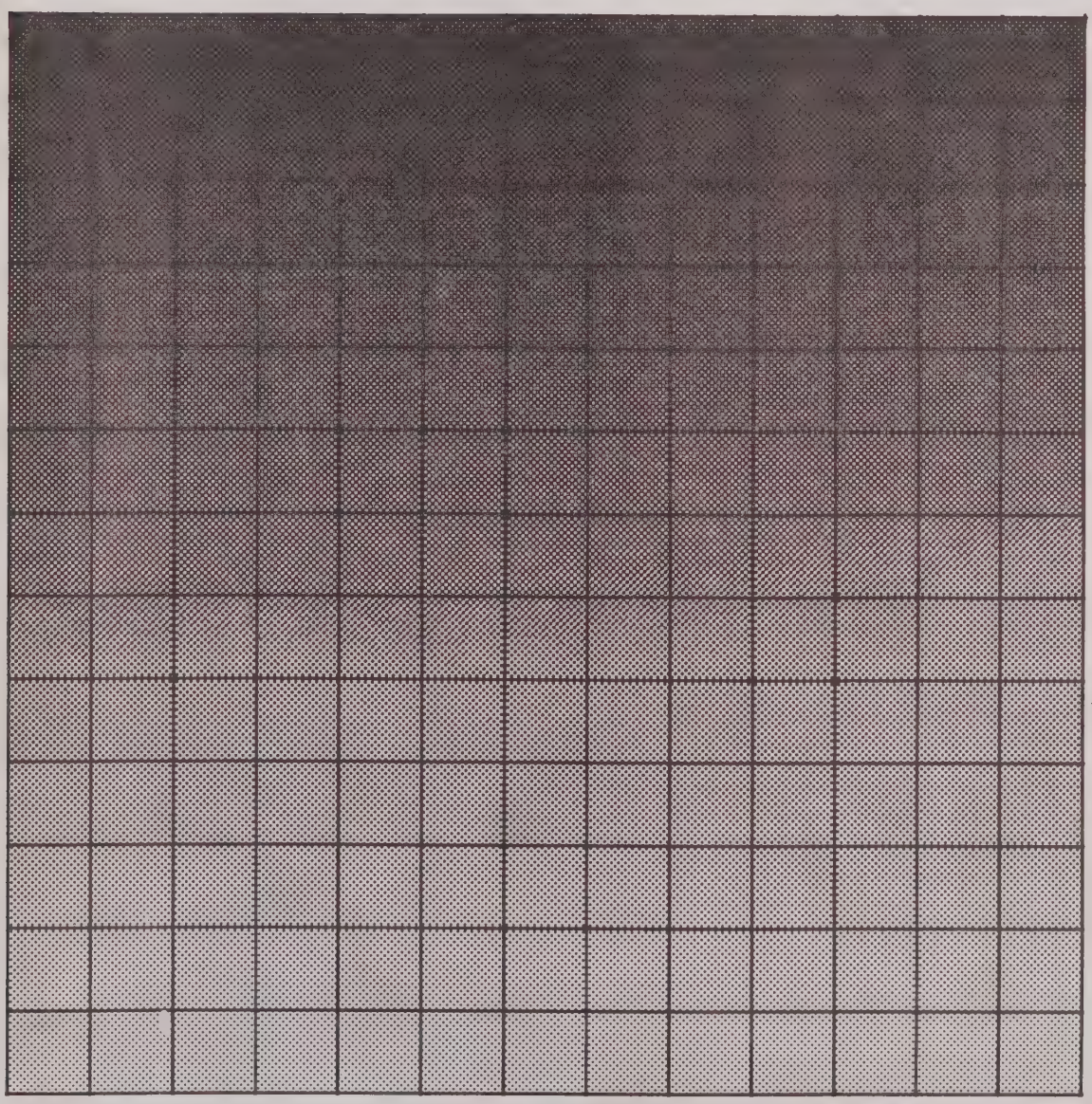
SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Store cylinders in a well ventilated area away from sources of heat and ignition. Cylinders should be returned with positive pressure.

OTHER PRECAUTIONS: Do not deface cylinders or labels and move cylinders only with an adequate hand truck.

PROGRAM GUIDE

Monitor
General Motors
1988-1991



Application

The 1988-1991 General Motors Monitor Disk is used in Sun model analyzers equipped with the Test Link or Data Link on-board computer interface.

This Program Guide explains important definitions, types of messages shown, test options available, and entries required for all versions of the disk.

Screens presented in this guide are the same for testing performed with each of the aforementioned analyzers. However, basic keypad layout and operation and page-to-page control may differ. Consult the appropriate section of the operator's manual of the analyzer being used (MCA-3000 and Interrogator 2), Test Link Operating Instructions (1805), or Data Link Operating Instructions (MEA-1500) for program disk initial operating procedures and general guidelines.

Be sure analyzer has been warmed up and has been properly calibrated before on-board computer testing begins. Also make sure all test leads are properly connected.

In addition to the engine analyzer, some test procedures may require the use of jumper wires, a test light, and a spark tester (Figure 1).

Read/Write Protect Tab

The Read/Write Protect Tab is located in the bottom left corner of the disk's labeled side (Figure 2). To protect the disk against accidental erasure of its contents, slide the tab so that there is an opening in the disk. The tab will then be in the "protect" position. When the tab is not in the protect position, the tab can be seen in the bottom corner of the disk's labeled side.

Before inserting the disk into drive, make sure the Read/Write Protect Tab is in the protect position.

FIGURE 1. Model ST-125 Spark Tester

VDU Displays

Included on VDU displays or program pages are test parameters, step-by-step test instructions, and test results.

Prompt messages appearing on the VDU ask the technician to make test selections and keypad entries. Prompt messages always appear in the same location on the VDU. See Figure 3. PRESS YES OR NO, PRESS CONT, and PRESS A NUMBER are commonly used prompt messages.

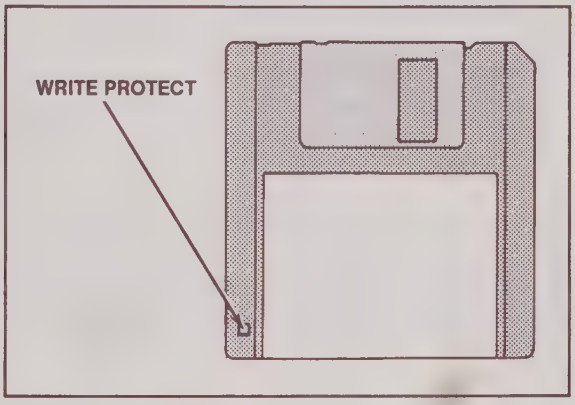


FIGURE 2. Write Protect

The heading which appears at the top of pages identifies the specific section the program is in. The number directly below the heading and to the right is a program code. This number is unrelated to the operation of the disk and may be disregarded. See Figure 3.

The HELP function is designed to provide the technician with additional information during the diagnostic program. Press HELP when the prompt appears. Figure 3 is an example of a HELP message.

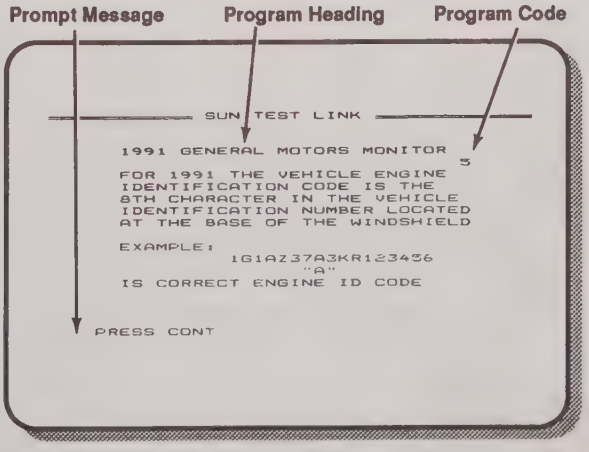


FIGURE 3. Example of HELP Information

The LOADING PROGRAM message appears at the bottom of the VDU when the Test/Data Link is transferring information from the disk into its memory. Wait until the next page displays before using the remote keypad.

Numeric entries on menu pages (ie., Main Menu, Vehicle Selection Page, etc.) each represent a different option. Always follow the prompt message on any program page for specific numeric entry instruction.

If a wrong double-digit numeric entry is made, press the CLEAR key and re-key the correct digit.

If a wrong single-digit entry is made, the program automatically advances to the next page. Press the BACKUP key to return to the preceding page and clear and correct the incorrect digit.

NOTE: Procedure for starting the program over (return to the Vehicle Selection Menu) to test another vehicle or verify previous data entered depends upon the analyzer being used. Consult appropriate operator's manual.

GM Applications

The GM Monitor Program covers 1988-1991 CCC, DFI, TBI, and PFI systems. These systems are controlled by an electronic control module (ECM). Additionally, some 1988-1991 DFI and PFI systems are also controlled by a body computer module (BCM).

NOTE: Some vehicles can only be tested with a Sun Interface equipped with bi-directional communication capabilities. These vehicles are identified by "( )" around the engine code number on the Vehicle Identification Code page and the Model Selection page, where applicable. See Figure 5 for an example.

System Types

1) Full Function System: equipped with carburetion and a full selection of sensors and solenoids.

2) Minimum Function System: equipped with carburetion and a limited selection of sensors and solenoids.

3) EFI/TBI System: equipped with Throttle Body Fuel Injection (TBI). Also called Electronic Fuel Injection (EFI).

4) Port Fuel Injection (PFI) System: equipped with fuel injectors at each cylinder intake port. Depending on engine size and make, it is also known as Multiport Fuel Injection (MFI) or Sequential Fuel Injection (SFI) or Tuned Port Fuel Injection.

5) Digital Fuel Injection (DFI): equipped with two fuel injectors located in the throttle body on top of the intake manifold. Used only on Cadillac models.

Vehicle Code Entry

The 1988-1991 GM vehicle's engine control system must be identified by means of the engine code before testing can begin.

Application
1988-1991 ECM-CCC,TBI,DFI, PFI
1988-1991 BCM-DFI,PFI
1988-1991 GM Trucks
Capabilities
System Monitor/Trouble Codes

FIGURE 4. 1991 GM Monitor Capabilities Chart

1) Determine the vehicle's engine code. It is the eighth character from the left in the 15-digit Vehicle Identification Number (VIN) located at the base of the windshield. See Figure 3.

2) Enter the engine code when prompted (Figure 5). The on-board computer interface identifies the type of system to be tested from the engine code.

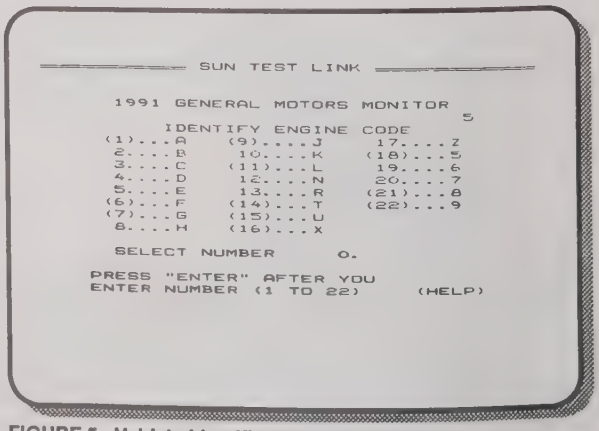


FIGURE 5. Vehicle Identification Code Page

Vehicle Type Selection

Following most engine code selections, a vehicle model type menu appears. Enter the vehicle type (Figure 6). Select what information system to use (Figure 7).

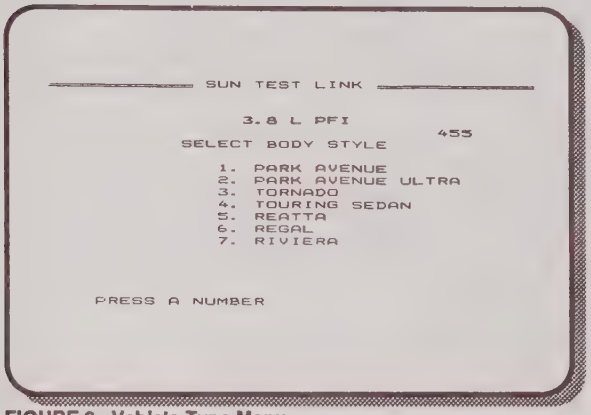


FIGURE 6. Vehicle Type Menu

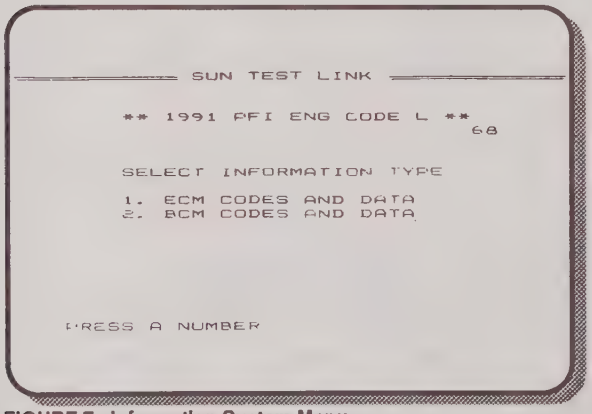


FIGURE 7. Information System Menu

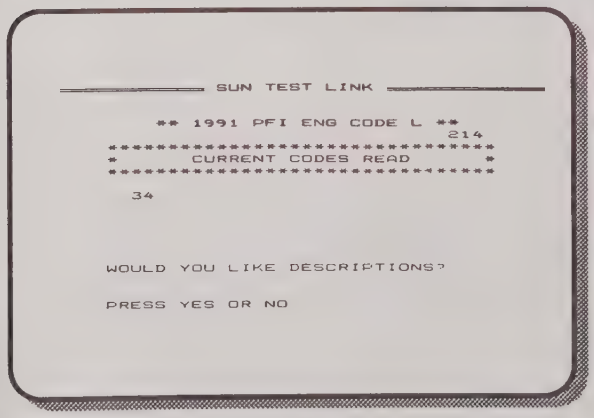


FIGURE 8. ECM Trouble Code Page

Trouble Code Displays

The GM Monitor program displays the trouble codes which are stored in the ECM (Figure 8) or BCM, if applicable. Descriptions of what the codes mean are also available (Figure 9).

History Trouble Codes

After current trouble codes are displayed, some GM vehicles save intermittent codes known as history trouble codes (Figure 10). A history trouble code is often caused by a loose or faulty connection. It is not present at the time of service. History code screens all feature the number one (1) before the indicated code number. Descriptions of the codes are also available (Figure 11).

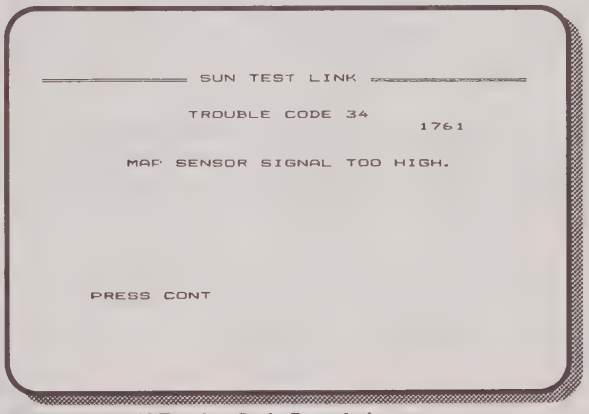


FIGURE 9. ECM Trouble Code Description

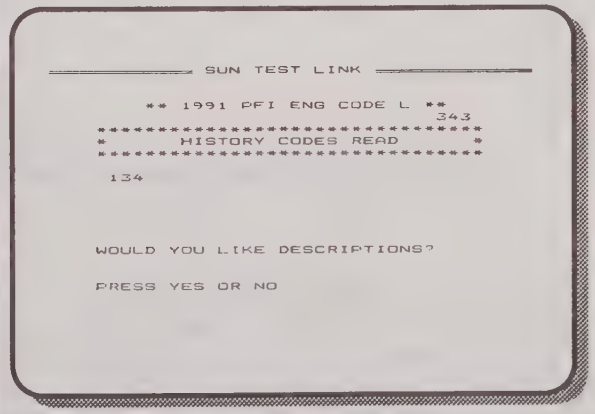


FIGURE 10. ECM History Trouble Code Page

After trouble code display and description (if selected), the system operating information may be viewed (if selected) by the technician.

NOTE: If there were no trouble codes stored in the ECM, or BCM, if applicable, the Monitor program proceeds AUTOMATICALLY to the system operating information.

Special Operating Modes (Figure 12)

On 1988 - 1991 GM systems the following monitor modes are available:

Normal (No Change To Systems)—This mode allows data update for selected engine codes without altering engine operating conditions, providing unmodified values. If this mode is selected and data does not update, the mode is not available on that engine.

Field Service Mode (Ground) —This mode lets the vehicle computer set a fixed timing value and allows bypass of the closed loop timers.

3.9K (Verify Backup Spark and Fuel Control Mode.) —This mode puts the vehicle in its backup spark and fuel control mode. This allows the technician to verify the vehicle will operate in this mode. This feature is also dependent on new capabilities.

10K Mode—Certain system values, such as idle RPM, will be fixed in this mode. The number and type of fixed or forced conditions may vary from engine to engine.

NOTE: On some vehicles, if the key is turned off then back on while the display is in the monitor pages, information may not be sent from the ECM or BCM. It may be necessary to proceed through the remainder of the display pages and then re-select "monitor" to make the vehicle send information again.

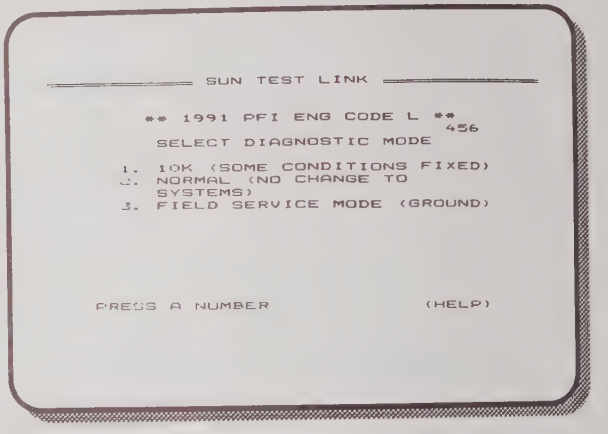


FIGURE 12. Diagnostic Mode Menu

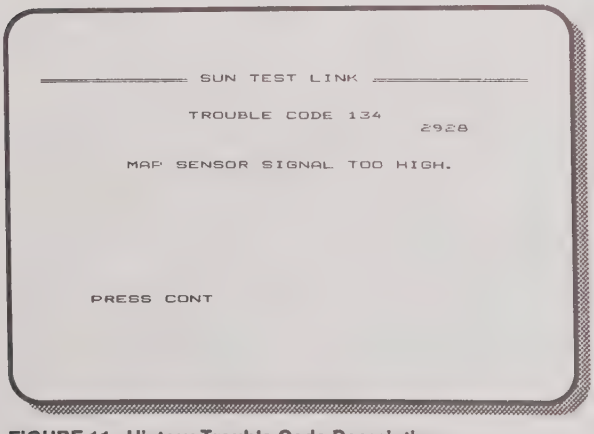


FIGURE 11. History Trouble Code Description

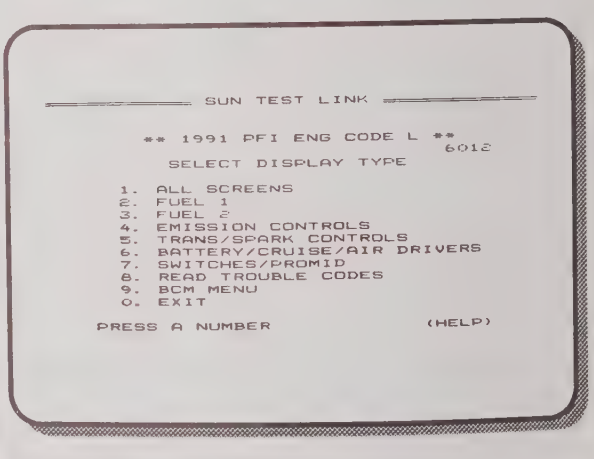


FIGURE 13. Display Type Menu

System Operating Information

The GM Monitor allows the technician to directly observe the operation of the system that was chosen. There are three types of systems ECM, BCM, and ABS. Use the select display screen (Figure 13) to select what information is needed.

Inputs are voltage signals sent by the sensors to the Electronic Control Module (ECM) / Body Control Module (BCM) about vehicle operating conditions. Outputs are commands sent by the ECM, BCM, to the actuators in response. See Figure 14 ECM operating information; (Figure 15) for BCM information.

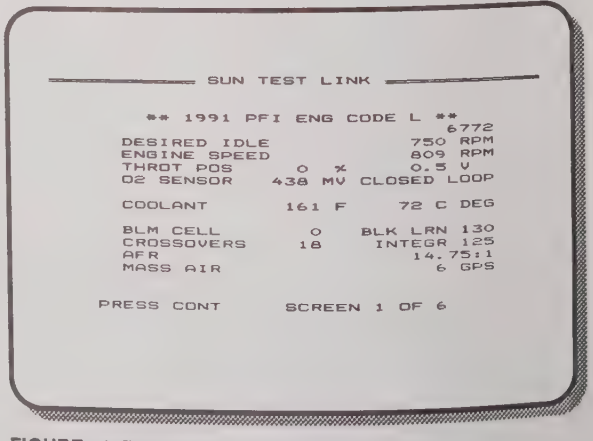

SUN TEST LINK
** 1991 PFI ENG CODE L **
6772
DESIRED IDLE 750 RPM
ENGINE SPEED 809 RPM
THROT POS 0 % 0.5 V
02 SENSOR 438 MV CLOSED LOOP
COOLANT 161 F 72 C DEG
BLM CELL 0 BLK LRN 130
CROSSOVERS 18 INTEGR 125
AFR 14.7:1
MASS AIR 6 GPS
PRESS CONT
SCREEN 1 OF 6

FIGURE 14 PFI ECM Operating Information

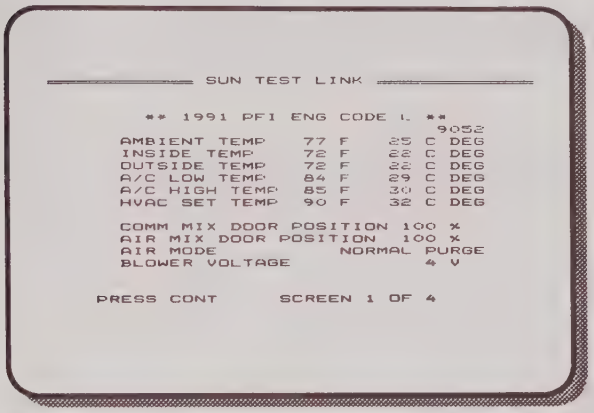

SUN TEST LINK
** 1991 PFI ENG CODE L **
9052
AMBIENT TEMP 77 F 25 C DEG
INSIDE TEMP 72 F 22 C DEG
OUTSIDE TEMP 72 F 22 C DEG
A/C LOW TEMP 84 F 29 C DEG
A/C HIGH TEMP 85 F 30 C DEG
HVAC SET TEMP 90 F 32 C DEG
COMM MIX DOOR POSITION 100 %
AIR MIX DOOR POSITION 100 %
AIR MODE NORMAL PURGE
BLOWER VOLTAGE 4 V
PRESS CONT SCREEN 1 OF 4

FIGURE 15 PFI BCM Operating Information

SYSTEM OPERATING DEFINITIONS

Below are explanations of the terms used in the system operating pages.

A/C Clutch Relay:
This indicates the status of the air conditioning clutch relay; either YES or NO.

A/C Fan Request:
Indicates a command for the A/C cooling fan; either YES or NO.

A/C Head Pressure:
Monitor indicates the air conditioning head pressure; either HIGH or NORMAL.

A/C HI Fan Request:
This indicates whether or not the Hi Fan has been requested; either YES or NO.

A/C Low Pressure Switch:
This indicates the status of the air conditioning low pressure switch; either NORMAL or LOW.

A/C Press:
This indicates the air conditioning pressure in volts and PSI.

A/C Pressure:
Monitor indicates HIGH or LOW showing the pressure in the A/C system.

A/C Request:
Indicates that the ECM has received a signal for air conditioning (A/C or DEFROST).

Actual MAP:
Indicates MAP value in volts and kilo-pascal units (kpa).

Air Conditioner Clutch (A/C CLUTCH):
When the air conditioner is turned ON, this solenoid is ON, causing the idle speed control to anticipate the added load of the air conditioning.

Air Control:
Indicates NORMAL or DIVERT depending on the command issued by the ECM.

Air Cont Solenoid:
Monitor indicates the status of the air control solenoid; either ON or OFF.

Air Divert:
This indicates the status of the air diverter valve; either CONVERTER or PORT.

Air Flow:
Number displayed indicates the grams of air per second that are flowing through the air flow meter.

Air Fuel Learned:
This indicates if the ECM has "learned" another air fuel setting; either YES or NO.

Air Fuel Ratio:
Displays ratio of air to fuel.

Air Solenoid:
Indicates ON or OFF showing status of the solenoid.

Air Switch:
Indicates PORT or CONVERTER depending on the command issued by the ECM.

Air System:
Monitor indicates the status of the air management system; either PORT or DIVERT.

Altitude:
This indicates high altitude switch; either YES or NO.

Barometric Pressure Sensor (BARO):
The BARO sensor measures changes in barometric pressures due to weather or altitude. Barometric pressure is expressed in kilo-pascal units (kpa) and volts. High voltage readings indicate high pressure and a corresponding signal is sent to the ECM to output a signal for more fuel. The voltage is normally between 3 and 4.5 volts, varying with barometric pressure and altitude. Minimum function systems use an altitude switch.

Baro Pressure:
The barometric pressure reading is expressed in kpa.

Baro Switch:
Indicates status of the switch (ON or OFF).

Battery:
The battery voltage will be displayed depending on the system application.

BLM Cell or Block Learn Cell:
Indicates a count from 0 to 16 showing which "cell" of information the ECM is using for fuel calculations.

BLM Learn:
This indicates the block learn multiplier "learning" mode is either DISABLED or ENABLED.

BLM Learn Enable:
Indicates if the block learn multiplier "learn" mode is enabled; either YES or NO.

Block Learn Numbers (BLOCK LEARN):
Numbers (0-255) indicate long term adjustments made to the fuel mixture. The long term adjustments are based on the number of times the integrator makes the same fuel mixture adjustment over a longer period of time. Used on EFI only.

Boost Press:
This indicates how much boost pressure the turbo-charger is creating (in kpa).

Brake Switch:
Shows the status of the brake light switch (ON or OFF). Operates only when the cruise is turned on.

Bypass Line Volts:
Indicates the status of the bypass line; either HIGH or LOW.

Canister Purge:
Indicates if the ECM is purging the canister (ON or OFF).

Can Purge:
This indicates the status of the canister purge system; either ACTIVE or INACTIVE.

Canister Purge DC:
Indicates the position of the canister purge valve; from 0 to 100%.

CCP Duty Cycle:
This indicates the position of the canister purge valve from open to closed in % of duty cycle.

CO Adjustment:
The CO adjustment reading is displayed in volts.

CO Adjust Mode:
This indicates the status of the CO adjustment mode; either ACTIVE or INACTIVE.

Cooling Fan:
Monitor indicates the status of the cooling fan; either ON or OFF.

Coolant Fan Relay:
Indicates the status of the coolant fan relay; either ON or OFF.

Coolant Temperature (COOLANT):
The engine coolant temperature displayed in degrees Celsius and F is the temperature reading being sent by the coolant temperature sensor (CTS) located in the coolant stream to the ECM.

Cranking Speed:
This indicates the rpm the engine cranks.

Crossovers:
This indicates in counts the number of times the O_2 sensor went from RICH to LEAN.

Cruise:
Indicates the status of the cruise control switch (ON or OFF).

Cruise Enable:
This indicates the status of the cruise control enable switch; either YES or NO.

Cruise Engaged:
Indicates if the cruise control switch has been engaged; either YES or NO.

Cruise On:
Indicates the status of the cruise control system; either YES or NO.

Cruise On/Off:
Indicates the status of the cruise control system; either ON or OFF.

Cruise R/A Switch:
Indicates the status of the resume/accel switch (ON or OFF).

Cruise Resume/Accel:
Indicates the status of the resume/accel switch; either YES or NO.

Cruise S/C Switch:
Indicates the status of the set/coast switch (ON or OFF).

Cruise Set/Coast:
Indicates the status of the cruise control set/coast switch; either YES or NO.

Cruise Servo:
Monitor indicates the position of the cruise control servo in percent.

Cruise Set Speed:
This indicates the speed setting (mph) of the vehicle cruise control.

Cruise Vac Sol:
Monitor indicates the status of the cruise control vacuum solenoid; either ON or OFF.

Cruise Vent Sol:
Monitor indicates the status of the cruise control vent solenoid; either ON or OFF.

CT Correction:
Indicates the closed throttle duty cycle correction (in degrees).

Current Weak Cyl:
This indicates the current weak cylinder (if existing, shows low on power output).

Desired Idle:
The monitor indicates the optimum idle rpm as designated by the vehicle's ECM.

Desired MAP:
The monitor indicates the optimum MAP value (in volts and kpa) as designated by the vehicle's ECM.

EFE Solenoid:
The ECM controls the EFE system through either a vacuum-operated valve and solenoid located on the valve cover or a relay and ceramic heater grid underneath the carburetor primary bore. The relay or solenoid is either ON or OFF to heat up the intake manifold during cold engine operation and aid the process of air-fuel mixture.

EGR:
Monitor indicates the status of the exhaust gas recirculation system; either ACTIVE or INACTIVE.

EGR Diagnostic:
Indicates if vacuum is being applied to the EGR valve (YES or NO).

EGR Duty Cycle:
A percentage is used to express the position of the EGR valve (from closed to open).

EGR Position:
Indicates the position of the EGR valve in volts.

EGR Solenoid 1:
Monitor indicates the status of exhaust gas recirculation solenoid 1; either ON or OFF.

EGR Solenoid 2:
Indicates the status of exhaust gas recirculation solenoid 2; either ON or OFF.

EGR Solenoid 3:
Indicates the status of exhaust gas recirculation solenoid 3; either ON or OFF.

EGR Vacuum Switch:
Presents status of the EGR vacuum switch (VACUUM or NO VACUUM).

EGR Valve:
Indicates the status of the exhaust gas recirculation valve; either ON or OFF.

Engine Speed:
Engine speed is displayed to allow the comparison of data at different rpm's. The signal for engine rpm comes from the distributor reference pulses.

EPR:
Shows the current status of the exhaust pressure regulator valve (OPEN or CLOSED).

ESC System:
Indicates if there is or has been a problem in the electronic spark control system. Shows FAILED or NORMAL.

EST Command:
Indicates the status of the electronic spark timing command; either YES or NO.

Exhaust Gas Recirculation (EGR) Solenoid:
When the engine is cold and the electrically-operated EGR solenoid is ON, vacuum is blocked to the EGR valve. In the OFF position, ported vacuum is allowed to reach the valve.

Fan:
This indicates the staus of the fan request; either YES or NO.

Fan 1:
Indicates if Fan 1 has been commanded to run (ON or OFF).

Fan 2:
Indicates if Fan 2 has been commanded to run (ON or OFF).

Fan Relay:
Displays the current status of the fan relay (ON or OFF).

Fan Request:
Indicates if the ECM has commanded the cooling fan to run (ON or OFF).

Fan Solenoid (FAN):
Indicates if the engine cooling fan is ON or OFF.

Filtered Load Variable (LV8):
Number displayed is proportional to the measurement of the amount of air that is being displaced per cylinder.

Fuel Back-up:
Monitor indicates ON when injector pulses are being supplied to the engine automatically when the ECM has failed. Fuel-injected models only.

Fuel Cut-off:
Indicates the status of the solenoid (ON or OFF).

Fuel Integrator:
Numbers (0-255) indicate short-term adjustments to the fuel mixture. Used on EFI only.

Fuel Pump:
Displays voltage at the fuel pump.

1st Gear MT/ 4th Gear AT:
Shows status (ON or OFF) of 1st gear switch in a manual transmission or the 4th gear switch in an automatic transmission.

2nd Gear (2ND GEAR):
Indicates status of the 2nd gear switch (YES or NO).

3rd Gear (3RD GEAR):
Switch is either ON or OFF depending on the state of the transmission.

4th Gear (4TH GEAR):
Switch is either ON or OFF depending on the state of the transmission.

Heated Windshield:
Indicates the status of the heated windshield; either YES or NO.

HI Fan:
Indicates if the ECM has commanded the high fan to run (YES or NO).

High Gear:
Indicates if the transmission has shifted into high gear (ON or OFF).

IAC Learned:
Indicates if the ECM has "learned" an idle air control position; either ON or OFF.

Idle Air Position (IAC POS):
Relates to IAC. The degree of air bypass is indicated by a percentage. A low percent correlates with low idle speeds; high percents with increased rpm.

Idle Switch:
Displays the status of the switch (IDLE or OFF IDLE).

Ignition Reference Pulses:
Shows a count of reference pulses recorded during cranking.

ILC Solenoid:
Indicates the status of the idle load control solenoid (ON or OFF).

Injector Pulse Width:
Indication of ON time for the fuel injectors in milliseconds. Fuel-injected models only.

Inlet Air Temp Switch:
Displays the status of the switch (ON or OFF).

Intake Air Sol:
Indicates the status of the intake air solenoid; either ACTIVE or INACTIVE.

Integrator Numbers (INTEGRATOR CNT):
Numbers (0-255) indicate short-term adjustments to the fuel mixture. Used on EFI only.

ISC Direction:
Indicates the current status of the idle speed control motor (FORWARD or REVERSE).

Knock Retard or Knock Count:
Sensor sends data to the ESC regarding detonation or engine knock. Monitor indicates the amount of spark retard adjustment in counts or degrees.

Knock Signal:
Reading indicates the number of times the ECM received a signal from the knock sensor.

Learned IAC:
Indicates the idle air control "learned" position in counts from 0 to 255.

Left Inj Pulse:
This indicates the left fuel injector pulse width reading; displayed in millivolts.

Left O_2 Sensor:
Indicates the voltage output of the left oxygen sensor in millivolts.

Loop Status:
Indicates when vehicle is in open or closed loop. "Open" loop is the operating condition apparent when the computer sets air-fuel ratio without the use of oxygen sensor information. The following conditions cause open loop: wide open throttle, 0_2 sensor cold, engine cold, or the presence of selected malfunctions.
Low A/C Pressure:
Indicates if the pressure in the air conditioning system is satisfactory (YES or NO).

Low Fan:
Indicates if the ECM has commanded the low fan to run (YES or NO).

Low Freon Sw:
Indicates the status of the low freon switch; either OPEN or CLOSED.

Manifold Absolute Pressure (MAP):
The MAP sensor measures changes in manifold pressure. A low voltage is produced when manifold pressure is low (manifold vacuum high); a high voltage when pressure is high (vacuum low). One volt or less indicates high manifold vacuum while 4.5 volts indicates low manifold vacuum.

Manifold Air:
Manifold air temperature is displayed in degrees Fahrenheit or centigrade.

Map Pressure:
The MAP pressure reading is displayed in kpa.

Mass Air:
Indicates the amount of air passing through the air flow sensor (in grams per second).

M/C Dwell:
Used only on carbureted engines, the M/C solenoid regulates the air-fuel mixture. When the solenoid is ON, fuel is restricted and air admitted. When the solenoid is OFF, fuel is admitted and air restricted. M/C dwell readings vary between 10 degrees (lean) and 50 degrees (rich). 30 is the mid-range normal operating position.

O/D Switch:
Displays the status of the switch (ON or OFF).

Oil:
Indicates the engine oil temperature in degrees F and C.

O_2 RL Counts (Crossovers):
This is a count indicating how many times the mixture control changes from rich to lean or lean to rich. It reflects the activity level of the 0_2 sensor.

Oxygen (O_2) Sensor:
The oxygen sensor is mounted in the exhaust stream and indicates when the fuel mixture is too rich or too lean through voltage signals. The GM Monitor expresses this by a rich/lean indication or a millivolts (mv) reading depending on the system application.

Park/Neutral (P/N) Switch:
When the gear selector is in Park or Neutral, the switch is ON. The switch is OFF when the vehicle is in gear.

Port Throttles:
Indicates the status of the secondary throttles; either OPEN or CLOSED.

Power Switch:
This indicates the status of the power switch; either NORMAL or FULL.

Power Steering (P/S) Switch:
Excessive power steering pressure is indicated. Otherwise normal.

Pressure:
The pressure reading is displayed in kpa or volts.

PROM ID:
Identifies the PROM used in the vehicle being tested. Each vehicle application uses a different PROM which must be matched if the PROM is replaced.

P/S Excessive:
Indicates the presence of excessive power steering pressure in the switch (YES or NO).

P/S Pressure:
The power steering pressure is displayed in kpa.

P/S Pressure Switch:
Indicates either NORMAL, CRAMPED, or HIGH power steering pressure.

PT Correction:
Indicates the part throttle duty cycle correction (in degrees).

QDM A:
Indicates the status of the quad driver module A; either HIGH or LOW.

QDM B:
Indicates the status of the quad driver module B; either HIGH or LOW.

QDM 1:
Indicates the status of quad driver module 1; either HIGH or LOW.

QDM 2:
Indicates the status of quad driver module 2; either HIGH or LOW.

QDM 3:
Indicates the status of quad driver module 3; either HIGH or LOW.

QDM 4:
Indicates the status of quad driver module 4; either HIGH or LOW.

Rear Vacuum Brake (REAR VAC BRAKE):
ON position indicates that the secondary vacuum brake has a vacuum signal. OFF indicates there is no vacuum signal.

1x Reference Pulses:
This indicates the 1x reference pulses (the synchronization signal) indicating crankshaft position.

Rich/Lean:
Indicates the current status of the fuel mixture.

Right Inj Pulse:
Indicates the right fuel injector pulse width reading; displayed in millivolts.

Right O_2 Sensor:
Indicates the voltage output of the right oxygen sensor in millivolts.

1-4 Shift Active:
Indicates if the trans shifted from 1st to 4th; either YES or NO.

1-4 Shift Enable:
Indicates the ability of the trans to shift from 1st to 4th under very light throttle; either YES or NO.

Shift Light:
Indicates the status of the shift light (ON or OFF).

Spark Advance:
The total spark advance as determined by the ECM is displayed in degrees.

Start Temp:
Indicates the temperature of the engine at start-up (in degrees Fahrenheit and Centigrade).

Sync Pulses:
The number of sync pulses is displayed as a count between 0 and 255.

TCC:
Indicates the status of the torque converter clutch; either ENGAGED or DISENGAGED.

TCC Applied:
Indicates the status of the torque converter clutch; either ON or OFF.

TCC Brake Switch:
This indicates the status of the torque converter clutch brake switch; either YES or NO.

TCC/Shift Light:
Indicates ON or OFF depending on vehicle speed, engine load, engine temperature, and engine rpm (shift light).

Throttle Kicker:
Indicates ON or OFF depending on commands issued by the ECM.

Throttle Position (THROT POS):
Located on the throttle body (EFI) or carburetor, the throttle position sensor (TPS) monitors changes in throttle position from closed to wide open throttle. The GM Monitor expresses throttle position as a percentage and as a voltage signal. Voltage readings from less than a volt to up to five volts comprise the range from closed to open.

Throttle Switch:
Displays the status of the switch (OPEN or CLOSED).

Time from Start:
Indicates how long the vehicle has been running (in minutes).

Torque Converter Clutch (TCC) Command:
The TCC solenoid signals the torque converter to mechanically couple the engine when engine temperature, vehicle speed, and load are within a specified range. TCC is ON during mechanical coupling; OFF during fluid coupling.

TPS:
Indicates the amount of throttle opening from closed to open in volts and percent (%).

Trans Temp:
Displays the temperature of the transmission in degrees Fahrenheit and Centigrade.

Upshift Light:
Indicates the status of the upshift light; either ON or OFF.

Vacuum (VAC):
Displays engine vacuum in volts or kpa.

VATS Status:
Indicates the vehicle anti-theft system status; either OK or NOT OK.

VCC Command:
Indicates the status of the viscous converter clutch (ON or OFF).

Vehicle Speed:
Vehicle speed is indicated to the ECM by the vehicle speed sensor (VSS).

Wastegate DC:
Indicates wastegate duty cycle in percent (%).

Wide Open Throttle (WOT):
Indicates when the throttle is wide open.

SUN ELECTRIC
CORPORATION

One Sun Parkway
Crystal Lake, Illinois 60014
(815) 459-7700

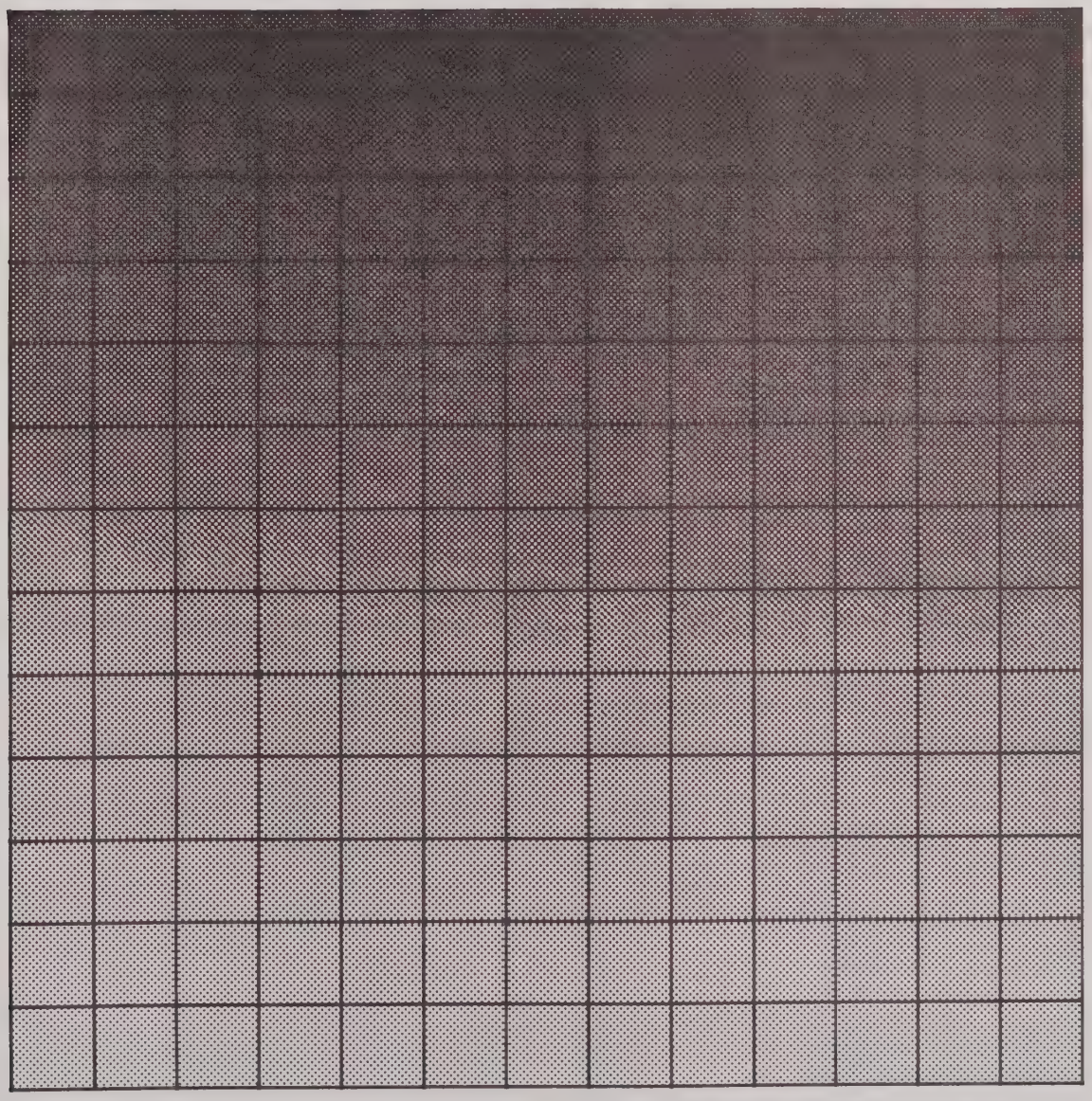
0692-1942-01 (1940)

© Sun Electric Corporation

Printed in U.S.A.

PROGRAM GUIDE

Monitor
Chrysler
1989-1991



Application

The 1989-1991 Chrysler Monitor Disk is used in Sun model analyzers equipped with the Test Link or Data Link on-board computer interface.

This Program Guide explains important definitions, types of messages shown, test options available, and entries required for all versions of the disk.

Screens presented in this guide are the same for testing performed with each of the aforementioned analyzers. However, basic keypad layout and operation and page-to-page control may differ. Consult the appropriate section of the operator's manual of the analyzer being used (MCA-3000 and Interrogator 2), Test Link Operating Instructions (1805), or Data Link Operating Instructions (MEA-1500) for program disk initial operating procedures and general guidelines.

Be sure analyzer has been warmed up and has been properly calibrated before on-board computer testing begins. Also make sure all test leads are properly connected.

Read/Write Protect Tab

The Read/Write Protect Tab is located in the bottom left corner of the disk's labeled side (Figure 1). To protect the disk against accidental erasure of its contents, slide the tab so that there is an opening in the disk. The tab will then be in the "protect" position. When the tab is not in the protect position, the tab can be seen in the bottom corner of the disk's labeled side.

Before inserting the disk into drive, make sure the Read/Write Protect Tab is in the protect position.

VDU Displays

Included on VDU displays or program pages are test parameters, step-by-step test instructions, and test results.

Prompt messages appearing on the VDU ask the technician to make test selections and keypad entries. Prompt messages always appear in the same location on the VDU. See Figure 3. PRESS YES OR NO, PRESS CONT, and PRESS A NUMBER are commonly used prompt messages.

The heading which appears at the top of pages identifies the specific section the program is in. The number directly below the heading and to the right is a program code. This number is unrelated to the operation of the disk and may be disregarded. See Figure 3.

The HELP function is designed to provide the technician with additional information during the diagnostic program. Press HELP when the prompt appears. Figure 2 is an example of a HELP message.

The LOADING PROGRAM message appears at the bottom of the VDU when the Test/Data Link is transferring information from the disk into its memory. Wait until the next page displays before using the remote keypad.

Numeric entries on menu pages (ie., Main Menu, Vehicle Selection Page, etc.) each represent a different option. Always follow the prompt message on any program page for specific numeric entry instruction.

If a wrong double-digit numeric entry is made, press the CLEAR key and re-key the correct digit.

If a wrong single-digit entry is made, the program automatically advances to the next page. Press the BACKUP key to return to the preceding page and clear and correct the incorrect digit.

NOTE: Procedure for starting the program over (return to the Vehicle Identification Sequence) to test another vehicle or verify previous data entered depends upon the analyzer being used. Consult appropriate operator's manual.

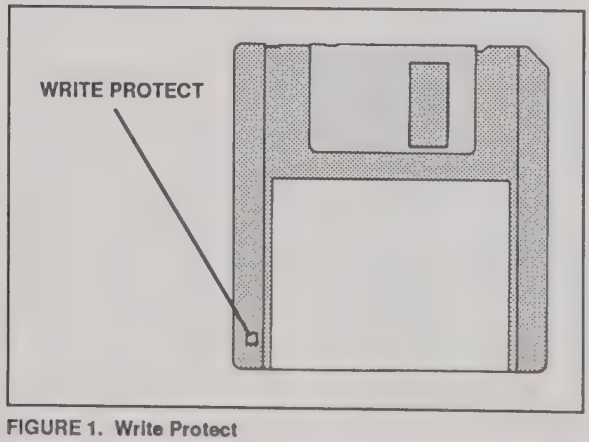


FIGURE 1. Write Protect

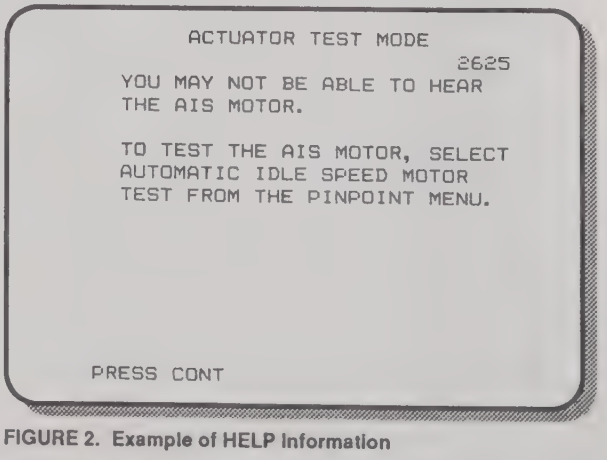


FIGURE 2. Example of HELP Information

CHRYSLER TESTS

The Chrysler Monitor Disk contains test procedures for 1989-1991 EFI vehicles (Figure 5).

NOTE: Some vehicles can only be tested with a Sun interface equipped with bi-directional communication capabilities. These vehicles are identified by "( )" around the selection number on applicable menu pages. Additionally, bi-directional communication is necessary to perform some system tests as well. Tests which require bi-directional communication are also indicated by "( )".

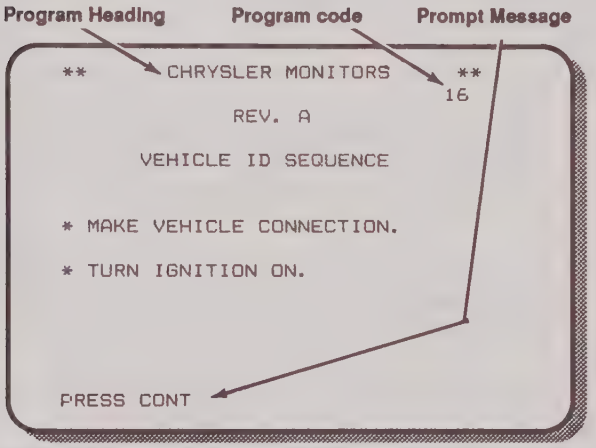


FIGURE 3. Vehicle Identification Sequence

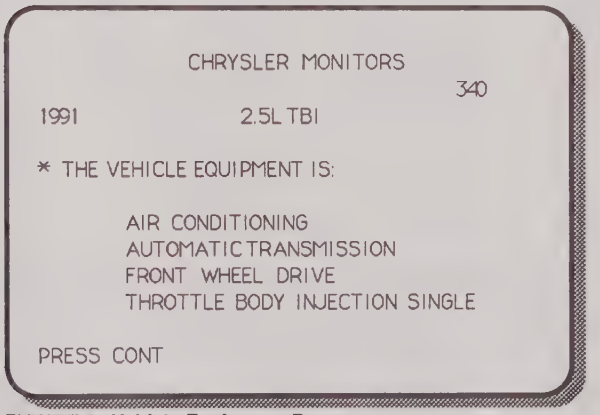


FIGURE 4. Vehicle Equipment Page

Application

1989-91 EFI-turbo, non-turbo

Capabilities

Fault Codes/ATM Test/Switch Test/Oxygen Test/ Sensor Test/Engine Running Test/Monitor Mode

FIGURE 5. Chrysler Monitor Disk Capabilities Chart

Model Year/System/Vehicle Type

For 1989-1991 Chrysler vehicles, engine information can be "read" from the vehicle being tested. In auto selection mode, the operator is prompted to make the vehicle connection and turn the ignition ON (Figure 3). When the information is "read", vehicle type is displayed along with specific equipment the vehicle contains (Figure 4).

The program will then go to the correct Main Menu based on the information read from the vehicle. Figure 6 shows the Main Menu for a 1991 2.2/2.5L TBI. Other vehicles may show a different Main Menu. All available test options are explained below.

Main Menu (Figure 6)

1. Fault Codes Test

This test option is used to directly access and display any fault codes stored in the logic module memory. Fault codes identify which circuit is bad, not the faulty component itself. See Figure 7 for an example of a fault code read.

From Fault Codes Test, a Test Access Page (Figure 10) can be displayed to continue with other system

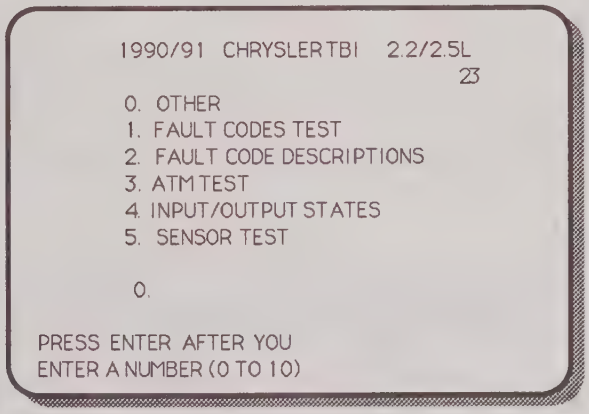


FIGURE 6. Main Test Menu (1991 2.5L TBI)

tests. Tests selected from the access page are explained in the Main Menu option descriptions that follow. Choose Switch Test first, as prompted, to perform testing from the access page.

2. Fault Code Descriptions

Descriptions of fault codes may be obtained by selecting Fault Code Descriptions from the Main Menu and then selecting a valid trouble code (Figure 9). Descriptions are also available on codes read from the vehicle (Figure 7 and 8).

```
                FAULT CODES
                                    436
        CHRYSLER FAULT CODES
--------------------------------
          FAULT CODES READ:

    15   24



DO YOU WANT DESCRIPTIONS?


PRESS YES OR NO
```

FIGURE 7. Fault Codes Read

```
                FAULT CODES
                                    463
    SELECT ONE OF THE FOLLOWING:

    1. INPUT/OUTPUT TEST
    2. ACTUATOR TEST
    3. INPUT/OUTPUT STATES

    0. RETURN TO MENU

    (IF INPUT/OUTPUT TEST IS
     DESIRED, PLEASE MAKE THIS
     YOUR FIRST SELECTION.)


  PRESS A NUMBER
```

FIGURE 10. Test Access Page

3. ATM Test

The actuator test mode is used to turn a specific output circuit on/off in order to verify actuator operation. The technician must look for physical signs from the actuator (such as clicking solenoids and relays, the presence of fuel or spark, pulsing voltages, etc.) that indicate a circuit is working properly.

Each selection made from the Actuator Test Mode Menu (Figure 11) will be followed by a page that describes the type of condition taking place. For example, Figure 12 indicates what the technician should look for if automatic idle speed motor (selection #6) actuator was chosen for examination.

After all actuator tests are performed, screen returns to the Main Menu or Test Access Page, depending on where the ATM test page was initially accessed.

```
                FAULT CODES
                                    676
              TROUBLE CODE 15
              ---------------

    OCCURS WHEN NO DISTANCE SENSOR
    SIGNAL IS DETECTED DURING ROAD
    LOAD CONDITIONS.




    PRESS CONT
```

FIGURE 8. Fault Code Description Page

```
            ACTUATOR TEST MODE
                                    2135
    0. OTHER
    1. SPARK ONCE EVERY 1.4 SECONDS
    2. INJECTOR PULSE #1
    3. INJECTOR PULSE #2
    4. INJECTOR PULSE #3
    5. INJECTOR PULSE #4
    6. AUTOMATIC IDLE SPEED MOTOR
    7. RADIATOR FAN RELAY
    8. A/C CUT-OUT RELAY
    9. AUTO SHUTDOWN RELAY
       0.
    PRESS ENTER AFTER YOU
    ENTER A NUMBER
```

FIGURE 11. Actuator Test Mode Menu

```
        1990/91 CHRYSLER TBI  2.2/2.5L
                                    238
            FAULT CODE SELECTION
        ------------------------

          SELECT ANY VALID FAULT CODE
    11,  13,  14,  15,  17,  21,  22,  23,
    24,  25,  27,  31,  32,  33,  34,  35,
    37,  41,  42,  46,  47,  51,  52,  53,
    62,  AND 63

  ENTER ""0" TO RETURN TO MENU.
       0.
  PRESS ENTER AFTER YOU
  ENTER A NUMBER (0 TO 63)
```

FIGURE 9. Fault Code Selection Page

```
            ACTUATOR TEST MODE
                                    2625
    AUTOMATIC IDLE SPEED MOTOR
    SHOULD OPEN AND CLOSE ONCE
    EVERY FOUR SECONDS.


    PRESS (CONT) TO RETURN TO
    ACTUATOR TEST MENU.




    PRESS CONT                  (HELP)
```

FIGURE 12. ATM (Automatic Idle Speed Motor) Description Page

4. Input/Output States

The input/output states mode is used to check the status of various input and output devices (Figure 13).

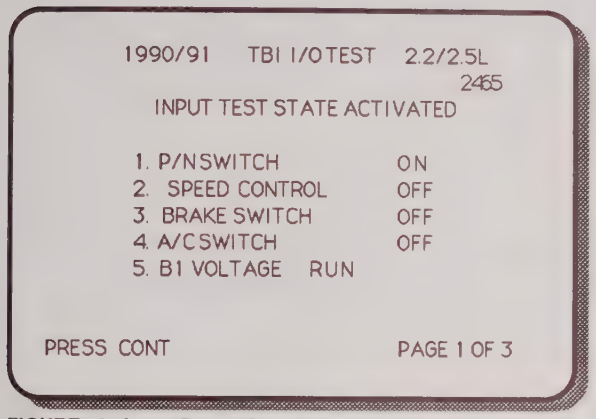


FIGURE 13. Input/Output State Page

5. Sensor Test

The sensor test mode allows the technician to examine values from various sensors and determine engine operating efficiency. The Chrysler Monitor displays sensor operating values one-at-a-time and will retain the last value of a sensor as a new one is selected. Figure 14 shows sensor values of a 1991 2.2/2.5L TBI system while collecting battery temperature voltage.

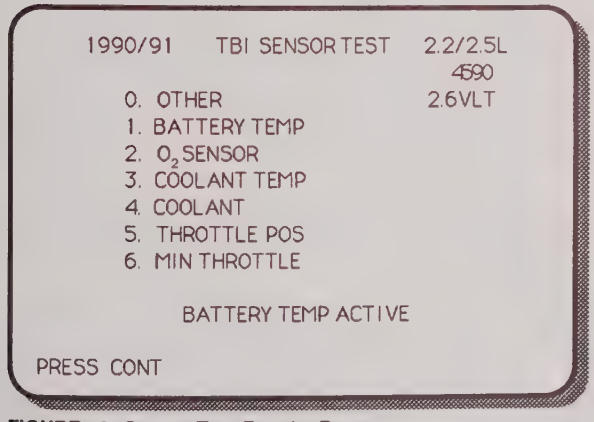


FIGURE 14. Sensor Test Results Page

6. Automatic Idle Speed Motor Test

This option allows the Sun interface to automatically signal the vehicle computer to increase engine speed to the rpm selected from the RPM Selection Page so that certain operating conditions can be examined. See Figure 15.

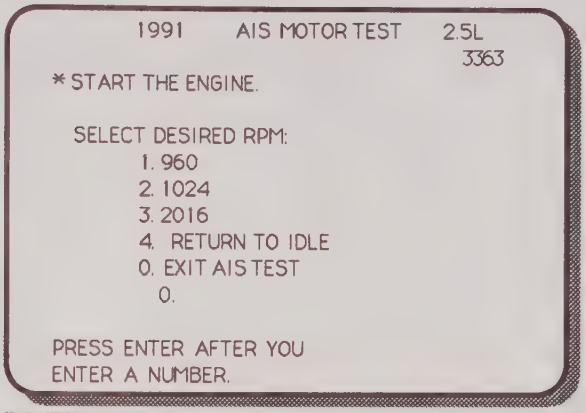


FIGURE 15. RPM Selection —Idle Speed Motor Test Page

7. EMR Test

The emission maintenance reminder test is used to turn the emission maintenance reminder light on the dash off. See Figure 16.

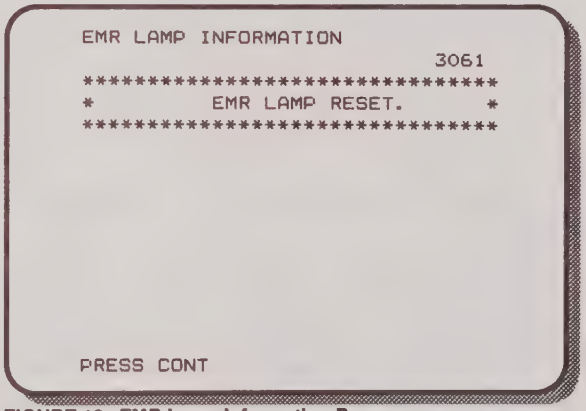


FIGURE 16. EMR Lamp Information Page

8. Monitor Data (MCA Only)

Selecting this option displays engine running data and allows the technician to view several "live" readings simultaneously. Figure 17 shows monitor data for a 1991 2.2/2.5L TBI vehicle.

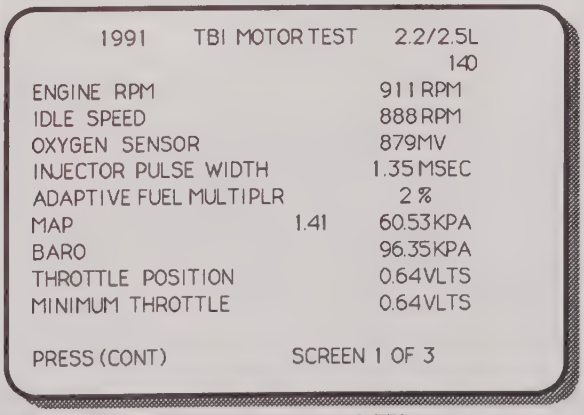

1991 TBI MOTOR TEST 2.2/2.5L
140
ENGINE RPM 911 RPM
IDLE SPEED 888 RPM
OXYGEN SENSOR 879MV
INJECTOR PULSE WIDTH 1.35 MSEC
ADAPTIVE FUEL MULTIPLR 2 %
MAP 1.41 60.53 KPA
BARO 96.35 KPA
THROTTLE POSITION 0.64 VLTS
MINIMUM THROTTLE 0.64 VLTS
PRESS (CONT) SCREEN 1 OF 3

FIGURE 17. Monitor Data (1991 2.2/2.5L TBI)

9. Clear Codes

This option selected from the Main Menu allows the interface to clear the fault codes. See Figure 18.

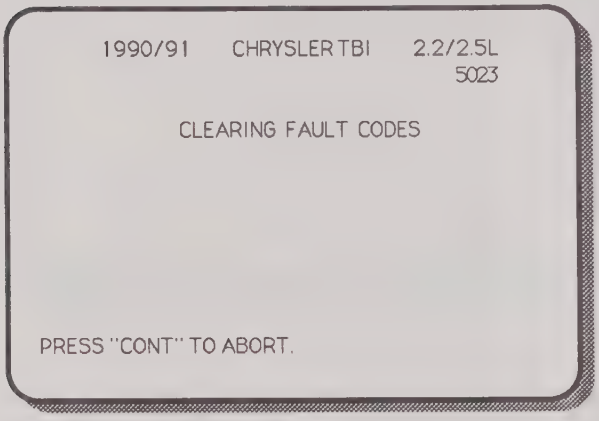


FIGURE 18. Clearing Codes Page

10. Select Next Vehicle

This test option returns the technician to the Vehicle Identification Sequence (Figure 3).

Other Main Menu options for select vehicles:

Switch Test (1989 2.2L Turbo II only)

The switch test mode is used to determine if inputs from the brake pedal switch, gear shift selector switch, A/C switch (if equipped), and rear window defogger are being received by the logic module. When the desired switch is turned on/off, the Sun interface will indicate if the logic module knows that the switch was activated. See Figure 19.

After the switch test is performed, the screen returns to the Main Test Menu or Test Access Page. The Test Access Page allows the operator to choose between Actuator Test and Sensor Test, if applicable.

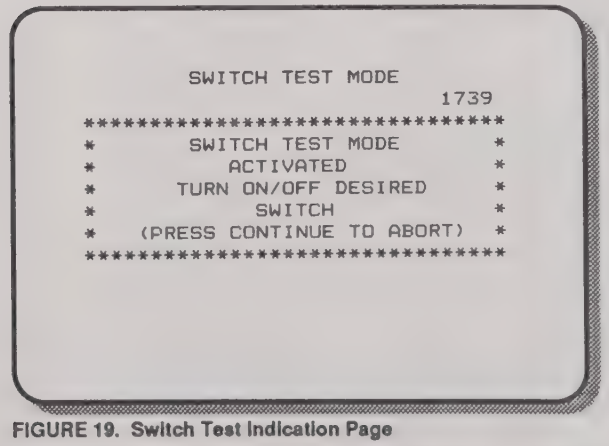


FIGURE 19. Switch Test Indication Page

Oxygen/Detonation Test (1989 2.2L Turbo II only)

From the Main Menu, a closer look at the oxygen sensor and the oxygen feedback system is available. The test page will show a RICH-LEAN crossover indication if the system is operating properly (Figure 20). This indication appears when the engine is completely warmed.

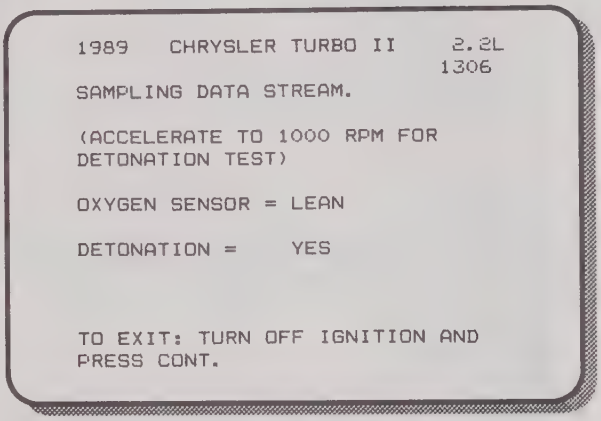

1989 CHRYSLER TURBO II 2.2L
1306
SAMPLING DATA STREAM.
(ACCELERATE TO 1000 RPM FOR DETONATION TEST)
OXYGEN SENSOR = LEAN
DETONATION = YES
TO EXIT: TURN OFF IGNITION AND PRESS CONT.

FIGURE 20. Oxygen Test Indication Page

Engine Running Data (1989 2.2L Turbo II only)

The engine running data mode displays sensor information with engine in a normal running condition. Following an initial Running Test Instruction Page (Figure 21), the technician may choose to examine a variety of sensors depending on model year and fuel delivery system of the vehicle being tested. Figure 22 shows the sensors that can be examined during operation of the 1989 2.2L Turbo II.

Figure 23 gives an example of the operating data indicated when a particular sensor is chosen for examination.

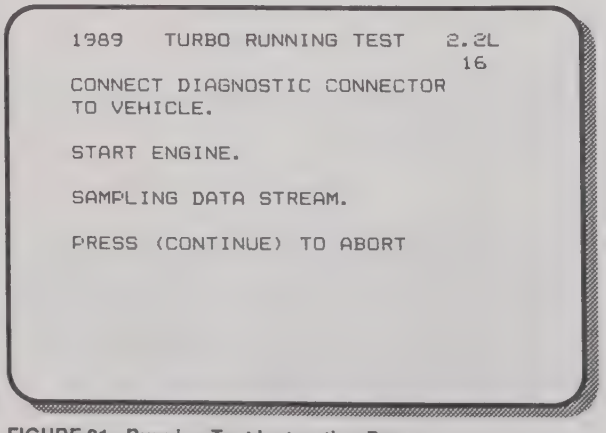


FIGURE 21. Running Test Instruction Page

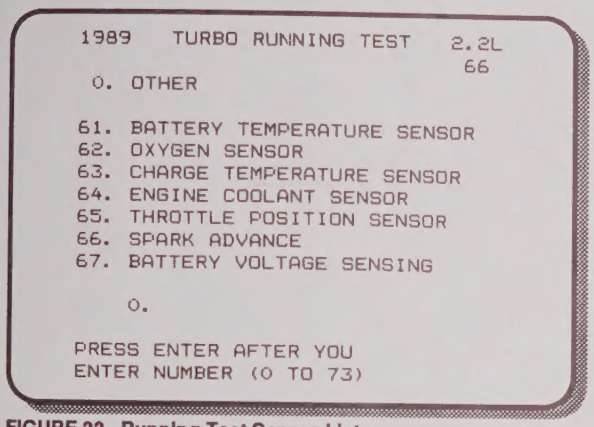


FIGURE 22. Running Test Sensor List

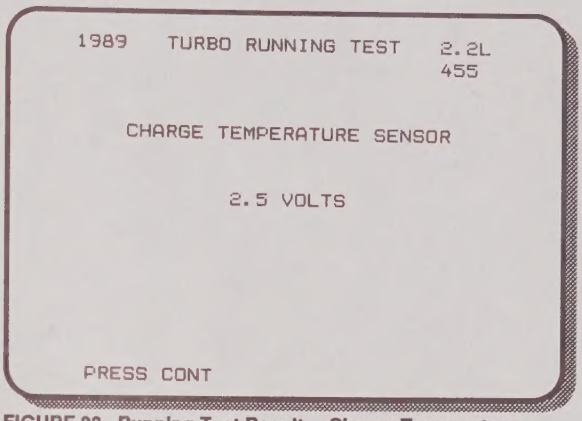


FIGURE 23. Running Test Result —Charge Temperature Sensor

SUN ELECTRIC
CORPORATION
One Sun Parkway
Crystal Lake, Illinois 60014

0692-1944-01 (1940)
© Sun Electric Corporation
Printed in U.S.A.

ACCO 572 Loose Leaf Diskette Panel
Stock No. 50407 MADE IN MEXICO